Shop Test: The Best Home-Shop Dust Collectors

ISSUE 182 MARCH 2008

Better Homes and Gardens®

# WOOD®

Panel Doors in 30 Minutes

The #1 Secret to Spot-on Accurate Woodworking!
p. 80

Easy-to-Build & Rearrange

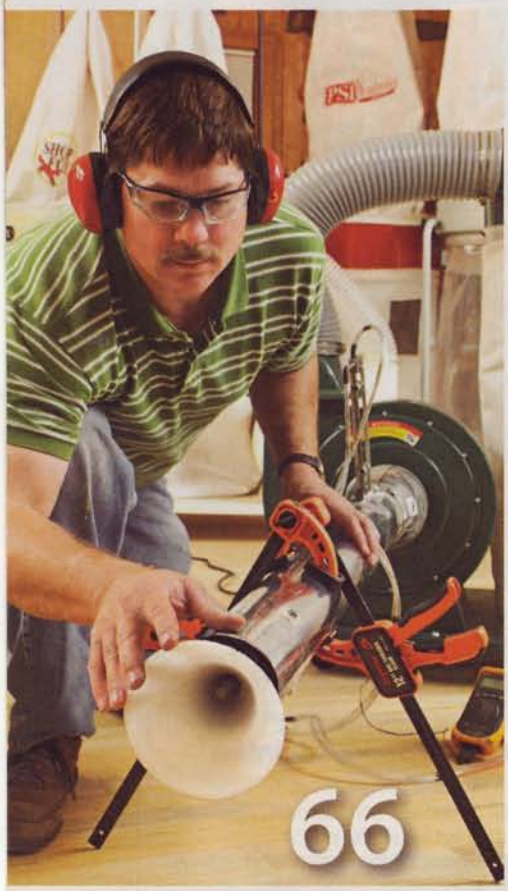
## SECTIONAL TABLES

Plus 7 More Terrific Projects

6 Ways to Make Your GOOD Router GREAT
p. 12

Display until March 18, 2008
0 3>
0 92567 14072 5
$6.99 U.S.

# in this issue




## PROJECTS


**24 Shop project: Outfeed/stock support**

**32 Two wooden puzzles**
Baffle your buddies with these easy-to-make mind-benders.

**38 Heirloom hutch**

**60 Cover project: Sectional tables**
Build as many as you like; then rearrange them when your needs change.

**72 Turned toothpick dispenser**

**76 Basic-Built project: Tool stand**

**82 Weekend project: Curvy ribbon clock**


## TECHNIQUES


**18 Just-right Joinery: Mitered half-laps**

**28 Make a zero-clearance tablesaw insert**

**46 30-minute frame-and-panel doors**

**50 Dovetail showdown: Man vs. machine**

**57 How to choose stock project parts**
No lathe? No problem. You can buy some turned or carved parts for less than you can make them.

**64 Stops: The pathway to perfect parts**

**80 Safety: Tablesaw shrapnel**

**88 Foolproof inset door installation**


## TOOLS & MATERIALS


**22 Wise buys: Dust collector remote switches**

**66 Shop-tested: Dust collectors under $400**
Confused about collector specs? You'll breathe easier after reading—and heeding—our findings.

**96 Shop-Proven Products**
Palm-size belt sander and stackable panel clamps


## DEPARTMENTS


**8 Editor's Angle**

**10 Sounding Board**

**14 Shop Tips**

**90 Ask *WOOD***

**108 What's Ahead**


WOOD MAGAZINE SHOP TESTED APPROVED®

This seal is your assurance that we build every project, verify every fact, and test every reviewed tool in our workshop to guarantee your success and complete satisfaction.

32

38

64

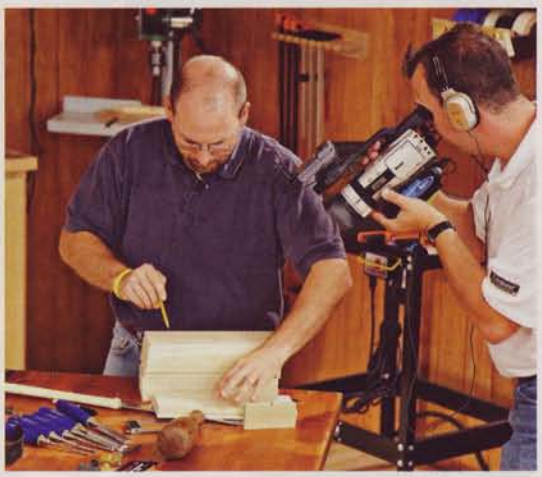
46

# on the web

woodmagazine.com

## WATCH THE DOVETAIL SHOWDOWN

**Hear the roar of the router and the whisper of the chisel** as the man-versus-machine Dovetail Showdown on *page 50* unfolds in a FREE video at woodmagazine.com/dtvideo



## FREE NEWSLETTER BETTER THAN EVER

WOOD e-Newsletter

**A master's program in woodworking in your e-mail box.** Get FREE project plans, up-to-the-minute tool news, and learn time-saving tips and techniques with every issue. Sign up today at woodmagazine.com/enews

## THE INSIDE STORY: EDITOR BLOGS

***WOOD*® magazine projects editor Owen Duvall** traveled to China recently and toured a musical-instrument factory where stringed instruments are still crafted by hand. See Owen's blog with photos at woodmagazine.com/odblog

## RATE THIS ISSUE

**Help us shape your magazine.** Pop by our Web site and tell us which articles, projects, and techniques you liked best in this issue. The short survey at woodmagazine.com/march08survey will take less than five minutes.

## DEER ME!

**We've added 25 new intarsia plans** from expert Judy Gale Roberts (including the handsome buck, *above*) to the more than 1,000 furniture and project plans already in the *WOOD* Store®. Get them at woodmagazine.com/intarsia

Bring to Life Each Treasured Story

Each piece of wood has its own story. From its unique lines and contours to the admiring attributes of color and form unfolds a story to be brought to life.

For over 50 years, Old Masters craftsman quality stains and finishes are produced to accentuate wood's natural beauty and provide durability for life's treasured pieces.

Old Masters® Since 1953

Call 800-747-3436 for a FREE product guide or visit www.oldmasters.biz to locate a dealer near you.

Proud Sponsor of:
Woodsmith SHOP
Shown weekly on PBS.

Circle No. 95

Better Homes and Gardens®
WOOD®
woodmagazine.com

March 2008 | Vol. 25, No. 1 | Issue No. 182

Marlen shows off the Greene-and-Greene-style sofa table he recently made.

EDITOR-IN-CHIEF
**BILL KRIER**

Managing Editor **MARLEN KEMMET**
Deputy Editor **DAVE CAMPBELL**
Art Director **KARL EHLERS**
Senior Design Editor **KEVIN BOYLE**
Techniques Editor **BOB WILSON**
Tool & Techniques Editor **BOB HUNTER**
Projects Editor **OWEN DUVALL**
Projects Editor **JAN SVEC**
Design Editor **JEFF MERTZ**
Master Craftsman **CHUCK HEDLUND**
Multimedia Editor **LUCAS PETERS**
Associate Art Director **GREG SELLERS**
Assistant Art Director **CHERYL A. CIBULA**
Production/Office Manager **MARGARET CLOSNER**
Administrative Assistant **SHERYL MUNYON**

Photographers
**MARTY BALDWIN, JASON DONNELLY, DEAN SCHOEPPNER, JAY WILDE**
Contributing Illustrators **TIM CAHILL, LORNA JOHNSON, ROXANNE LeMOINE**
Technical Consultants **JEFF HALL, PAT LOWRY**
Contributing Craftsman **JIM HEAVEY**
Contributing Proofreaders **BABS KLEIN, IRA LACHER, JIM SANDERS**

Dave made a crucifix that sold for $180 at a church auction.

Jim designed and built this vanity for his newly remodeled bath.

**SUBSCRIBER SERVICE**
Go to woodmagazine.com/help or write to
WOOD magazine, P.O. Box 37439, Boone, IA 50037-0439

Publisher **MARK L. HAGEN**

**ADVERTISING AND MARKETING**
**CHICAGO:** 333 N. Michigan Ave., Suite 1500, Chicago, IL 60601
Marketing Manager **AMANDA SALHOOT**
Advertising Managers **JACK CHRISTIANSEN, CAROLYN DAKIS**
Direct Response Advertising Representative **RYAN INTERLAND**
Assistants **GAYLE CHEJN, NIA WILLIAMS**
**ATLANTA:** Navigate Media
**DETROIT:** RPM Associates
Product Marketing Manager **DIANA WILLITS**

Business Manager **JEFF STILES**
Associate Consumer Marketing Director **DAN HOLLAND**
Associate Director of Marketing-Newsstand **TOM DEERING**
Senior Production Manager **MELANIE STOLTENBERG**
Advertising Operations Manager **JIM NELSON**
E-Commerce Manager **MATT SNYDER**

Group Publisher **TOM DAVIS**

**MEREDITH PUBLISHING GROUP**
President **JACK GRIFFIN**
Executive Vice President **DOUG OLSON**
Editorial Director **MIKE LAFAVORE**
Finance & Administration **MIKE RIGGS**
Manufacturing **BRUCE HESTON**
Consumer Marketing **DAVID BALL**
Corporate Sales **JACK BAMBERGER**
Interactive Media **LAUREN WIENER**
Corporate Marketing **NANCY WEBER**
Research **BRITTA WARE**
Chief Technology Officer **TINA STEIL**
New Media Marketing Services **ANDY WILSON**
Meredith CORPORATION

President and Chief Executive Officer **STEPHEN M. LACY**
Chairman of the Board **WILLIAM T. KERR**
**In Memoriam — E.T. Meredith III (1933–2003)**

Our subscribers list is occasionally made available to carefully selected firms whose products may be of interest to you. If you prefer not to receive information from these companies by mail or by phone, please let us know. Send your request along with your mailing label to Magazine Customer Service, P.O. Box 10263, Des Moines, IA 50336-0263.

© Copyright Meredith Corporation 2008. All rights reserved. Printed in the U.S.A.
Retail Sales
Retailers can order copies of WOOD for resale by e-mailing heather.proctor@meredith.com

WHEN THE SAWDUST SETTLES...

ZAR® finishes on top!

Whether you're creating your own masterpiece or want to give new life to a treasured family heirloom, only the best wood stain will do. ZAR Wood Stain's controlled penetration formula allows you to work at your own pace. ZAR Wood Stain wipes on easily and penetrates evenly for uniform color tone without streaks, lapmarks or blotches. So whether you're a professional or just want professional looking results - use ZAR Wood Stains and Clear Finishes.

You control the stain, It doesn't control you!

For a free brochure and the name of your nearest dealer call 1-800-272-3235, or visit us online at.ugl.com.

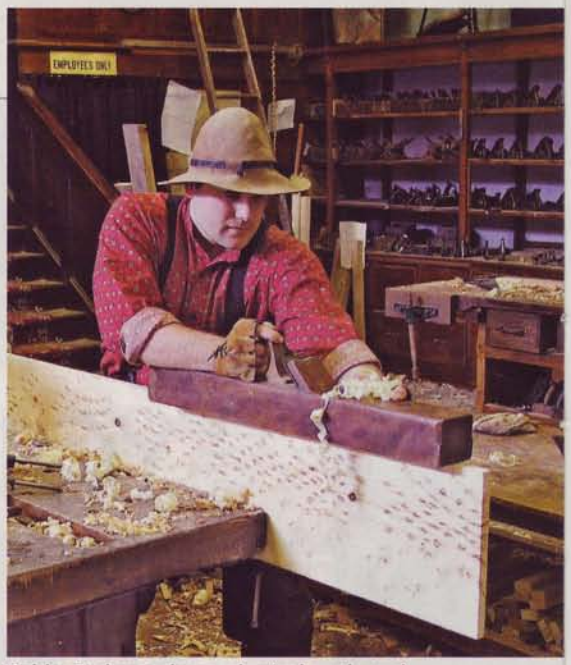
Circle No. 128

UGL UNITED GILSONITE LABORATORIES
P.O. BOX 71 SCRANTON, PA 18501 • JACKSONVILLE, IL • JACKSON, MS • DAYTON, NV


# Editor's Angle

# Putting some MUSCLE into it

**The comparison on *page 50* of hand-cutting versus machine-cutting dovetail joints took me back in time, back to 1875 to be exact; and to a woodworker who lives in that era every day.**




Robby Pedersen loves physical work, and he gets lots of it in his 19th-century shop.

I don't have to tell you about the advantages of power tools. You no doubt have a shop full of them, and dearly appreciate each one for the speed, ease-of-use, and great results it gives you.

With power tools all around us it's easy to forget that most of today's woodworking principles were developed over thousands of years by woodworkers using nothing but hand tools. And today you'll still find craftsmen who have unplugged their power tools to pursue woodworking as it was done pre-machine age—before we had dust collectors, air filters, respirators, ear muffs, and countless guards and pushsticks to protect ourselves from our hobby. You'll find these folks—affectionately known as "Neanderthals"—talking old tool ways on numerous woodworking Web sites.

One of them is Robby Pedersen, who worked on our staff several years ago before setting out on his own to build custom furniture full time. I doubt there's anyone more committed to using hand tools. He builds every piece of furniture almost entirely by hand, from tree to finished product. Yes, Robby even chops down the tree. He tells me a typical mature oak tree requires 800–1,000 axe swings over a 3–5 hour period (I'll take your word for it, Robby, and stick with my chainsaw, thank you). He crosscuts the trunk to log lengths by hand, but does make one concession to technology by using a motorized sawmill to turn the log into boards. From there it's back to using only hand tools to plane, saw, join, and scrape the stock. It's his passion to do everything as it was done more than 130 years ago, hence the name of his business: rvp1875. And if you're interested, he shares that knowledge through classes (find out more at rvp1875.com). He recently filled me in on these hand-tool truths:

- With practice comes speed. Robby estimates he can make a hand-dovetailed drawer in 30 minutes—about one-third the time it took us in the dovetail duel.
- Hand-tool use is great exercise. "I do well in triathlons—and don't train at all," he quips.
- Hand tools force you to understand the wood. "You spare yourself unnecessary work by not fighting the grain."
- Don't do the same task too long. "I'll cut mortises and tenons for a while, then switch to surface planing, then do something else. You get use to a different workflow in order to save your body."
- He quickly learned why yesterday's workbenches are shorter than today's. "Hand-planing surfaces absolutely wore out my arms until I cut my benches down 3" to shift the work from my upper body to my legs."
- But even a diehard Neanderthal appreciates machines, so long as they're not motorized. "I was tearing myself up hand-chopping hundreds of mortises until I got an 1870-era foot-powered mortiser—I love it," says Robby.

Bill Krier

# High Performance Power Tools

## Need the BEST Abrasives

Norton makes sanding easier with 3 times the total performance over conventional products. Ask your woodworking supplier for Norton 3X discs and sheets.

NORTON

THE MUSCLE BEHIND THE MACHINE

D-I-Y/Contractor Market www.nortonconsumer.com
Circle No. 2024


# Sounding Board

Our bulletin board for letters, comments, and timely updates

## Before you buy your next tablesaw blade...

Just as this issue was shipping to the printer, we discovered that a number of the performance grades for the Freud P410 tablesaw blade, at *right*, were incorrectly recorded in the review of general-purpose tablesaw blades (issue 181, December 2007/January 2008). We'll provide more details soon both online (woodmagazine.com), and in our next issue. After re-verifying our test results for that blade, though, we feel confident in adding the P410 to the list of Top Tools in that review. It's an especially good blade for cutting melamine-coated particleboard.

—WOOD® *Editors*

## Wanted: a talented editor

We have a rare opening on the *WOOD* magazine staff for a Projects Editor. This person will produce articles on a variety of woodworking topics including projects, techniques, and tools. Duties also include: overseeing how-to photography and illustrations; online content creation and assisting in video production; as well as managing special assignments. Occasional travel is required.

**Minimum qualifications:**

- Bachelor's degree in journalism, English, or communication. Technical writing experience is helpful.
- Specific hands-on knowledge of woodworking and woodworking tools and machinery.

Candidate also must be a strong writer and a self-starter, able to work in a team-oriented environment, use desktop publishing equipment, and communicate well over the phone and in person. Please note that this position is in Des Moines, Iowa.

Send your cover letter and resume to Dave Campbell at *WOOD* magazine, 1716 Locust St., LS-221, Des Moines, IA 50309; by e-mail to dave.campbell@meredith.com; or by fax to 515-284-2115. EOE.

## HOW TO REACH US

- **For woodworking advice:** Post your woodworking questions (joinery, finishing, tools, turning, general woodworking, etc.) on one of 14 online forums at **woodmagazine.com/forums**
- **To contact our editors:** Send your comments via E-mail to **woodmail@woodmagazine.com**; or write to *WOOD* magazine, 1716 Locust St., LS-221, Des Moines, IA 50309.
- **Updates to previously published projects:** For an up-to-date listing of changes in dimensions and buying-guide sources from issue 1 through today, go to **woodmagazine.com/editorial**
- **To find past articles:** See our index at **woodmagazine.com/index**
- **To order past issues and articles:** Order past issues of *WOOD* magazine, our special issues, or downloadable articles from issue 100 to present: Visit our online store at **woodmagazine.com/store**. Some issues are sold out.
- **Subscription assistance:** To notify us of an address change or to get help with your subscription, visit **woodmagazine.com/service**. Or write to *WOOD* magazine, PO Box 37439, Boone, IA 50037-0439. Please enclose your address label from a recent magazine issue.

# What's Ahead

A sneak peek inside the May issue (on sale March 18)

FEATURED PROJECT

## Classic rocker

Enjoy the comfort of the contoured seat and perfect balance of this chair indoors or out. You'll be rockin' in no time thanks to the no-nonsense glue, screw, dowel, and round-tenon joinery. The included patterns make it a snap to shape the curved parts.

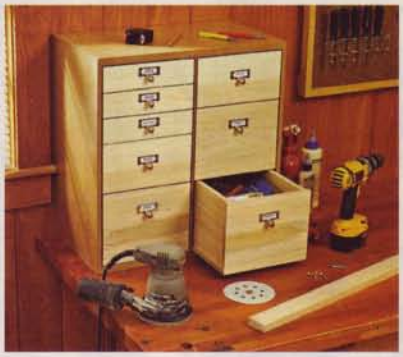
BASIC-BUILT
GREAT PROJECTS. SIMPLE TOOLS.

## Bench with storage

Stow seasonal gear or other items in this straightforward project joined with screws and glue.

## Knock-down bed

Wow the young adult on your gift list with this "Back to the Future" bed. Two sheets of plywood and simple hardware get you there.



## Shop organizer

Its modular design lets you choose a mix of three sizes of easy-to-build drawers.

TOOL TEST

## Shoulder planes

These handy tools help you trim tenons and rabbets to fit their sockets tightly. Our in-shop tests point you to the top-performing models.

## A Buyer's Guide to Tablesaws

In the market for a tablesaw but not sure which one to buy? You'll find the type of saw with features that best meet your needs.

## Rout dowels and round tenons

Make dowels from any wood species, or add round tenons to the ends of square stock using your router table.



*Better Homes and Gardens® WOOD®* magazine (ISSN-0743-894X) is published seven times a year in March, May, July, September, October, November, and December/January by Meredith Corporation, 1716 Locust St., Des Moines, IA 50309-3023. Periodicals postage paid at Des Moines, Iowa, and additional mailing offices. Better Homes and Gardens trademark registered in Canada and Australia. Marca Registrada en México. One-year subscription prices: U.S. and its possessions, $28; Canada, $41; other countries, $49. Canada Post Publications Mail Sales Product Agreement No. 40069223. Canadian BN 12348 2887 RT. Return undeliverable Canadian addresses to: Better Homes and Gardens WOOD magazine, 2635 Kew Drive, Windsor, ON, N8T 3B7. POSTMASTER: Send address changes to Better Homes and Gardens WOOD magazine, P.O. Box 37439, Boone, IA 50037-0439.

# 6 Simple Ways to Trick Out Your ROUTER

BROUGHT TO YOU BY
PORTER CABLE
The Measure of Precision

Every woodworker—regardless of skill level—should have at least one router in the shop. This versatile tool earns its keep profiling edges, cutting joints (everything from dadoes to dovetails), and plowing into surfaces for inset elements (such as inlay) to beautify projects. With a few well-chosen jigs and accessories, you'll increase its value even more. Here are the six top add-ons to enhance the performance of your router; you'll find more free router-related jigs, tips, plans, and videos at the Web site listed *below*.

**Watch two free videos demonstrating how to set up and use a dovetail jig and how to get the most benefit from your router table at woodmagazine.com/trickout.**

## LET A BUSHING BE YOUR GUIDE 1

Install a guide bushing in your router's base opening, and use it to follow an edge guide or template for routing pattern-perfect parts. Because you use an ordinary straight bit with no bearing, you can even plunge for template cuts in the field of a workpiece.

## THE UPSIDES OF A PLUNGE BASE

Fixed-base routers typically cost less than a plunge router and will handle most of the router-oriented tasks in your shop. But many fixed-base routers, such as the PORTER-CABLE 891 (*above right*), can be bought in a combination kit (model 894PK) that also includes a plunge base (*below*), adding the ability to start and stop a cut in the middle of a workpiece. These "field" cuts include stopped flutes and dadoes, as well as recesses in router-carved signs. The motor easily swaps between the bases, giving you the versatility of two routers for a little more than the price of one. As a bonus, you can mount the fixed base in a router table; then exchange the motor between it and the plunge base for handheld work.

2

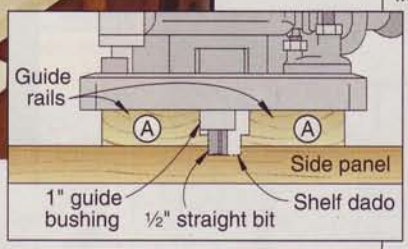
## ROUTER TABLE=GREATER CONTROL

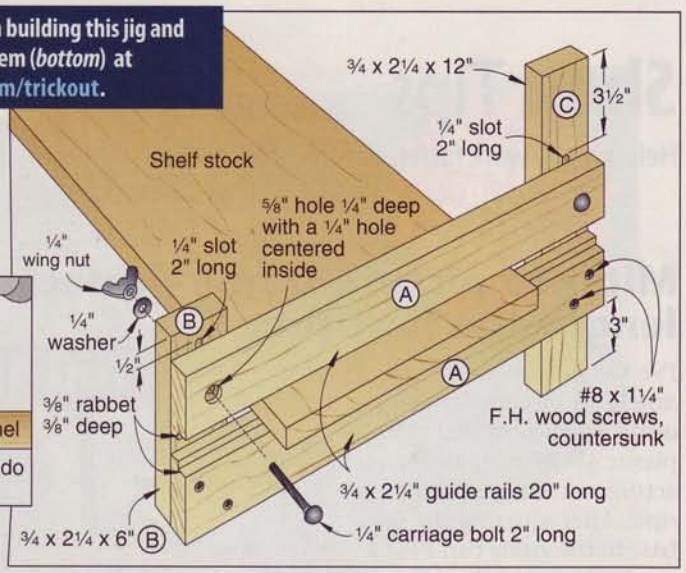
Mounting a router upside-down in a table gives you greater command of the workpiece and cutting action, especially on pieces too small to safely rout with a handheld router. Whether you buy one or build your own (find free plans at woodmagazine.com/trickout), insist on a perfectly flat tabletop, a precise and adjustable fence, and an effective dust-collection port. With those basics covered, consider an up-front switch to start and stop the router, and feather boards for ultimate workpiece control.

3

See more details on building this jig and the bit storage system (*bottom*) at woodmagazine.com/trickout.

4




## EXACT-WIDTH DADO JIG

Here's a jig for routing bookcase or cabinet-side dadoes that exactly match the thickness of your shelf stock. No special bits are needed. Just use an ordinary straight bit and a guide bushing. (We used a 1" guide bushing and a ½" straight bit.) To start, cut a ⅜" rabbet ⅜" deep along the inside edge of both guide rails (A). Then complete the jig, as shown in the drawing. To customize the rails for a different bushing and bit, use them to trim the rabbet in the guide rails. The remaining lip will now match your bushing/bit combo. To set the jig for your shelf stock, slip the jig over the shelf stock, as shown *above right*.

Snug the guide rails (A) against the stock, and tighten the wing nuts. Slip the jig off the stock, and clamp the jig onto the piece being dadoed, aligning the gap between the rails (A) over the marked dado on the side panel. Adjust the depth of cut with your router sitting on top of the rails. Rout one pass with the guide bushing riding against one of the rabbeted rails. Make a second pass riding the bushing against the opposite rabbeted rail.

5

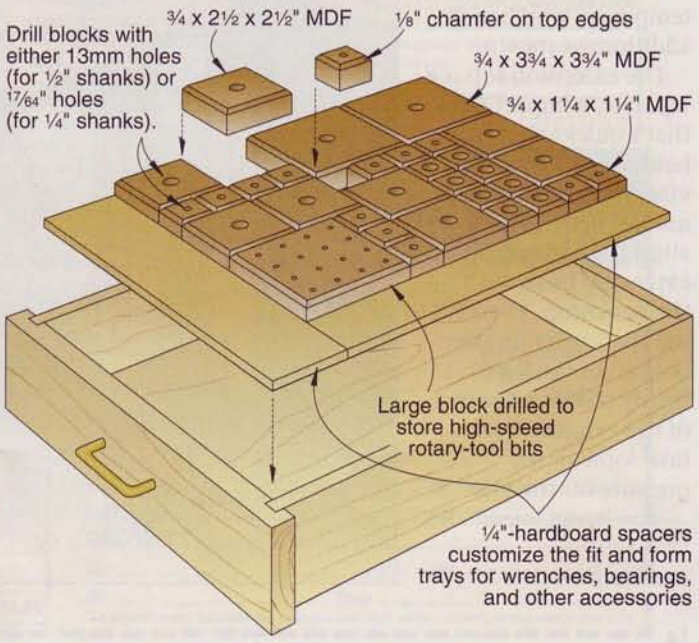
## PAINLESS DOVETAILS MADE BY MACHINE

Dovetail joints have long been considered the hallmark of quality woodworking. A precise, easy-to-use through-dovetail jig earns you that reputation without years of practice. Some, like the PORTER-CABLE Omnijig Joinery System 77240 shown, expand your repertoire with variable pin spacing (for that hand-cut look) and the ability to cut half-blind dovetails, sliding dovetails, and even box joints with included and optional accessories.

## ADD-'EM-AS-YOU-GO BIT STORAGE

6

This modular router-bit storage system fits into any drawer and easily grows to meet your expanding bit collection. A 1-2-3 progression of block sizes maximizes the number of possible arrangements. As shown, there's room for wrenches, guide bushings, and even one large block drilled to hold rotary-tool bits. To build your modular storage, rip and then crosscut ¾" MDF (medium-density fiberboard) into 1¼"-, 2½"-, and 3¾" squares. Drill centered, slightly oversize holes for easy bit removal; 17/64" and 13mm holes for ¼"- and ½"-shank router bits, and 7/64" and 9/64" holes for 3/32"- and ⅛"-shank high-speed rotary-tool bits. Dip the blocks into an oil-varnish blend, such as Danish oil, and after wiping off the excess finish with a rag, dry the blocks on a window screen propped on sawhorses. With the finish dry, arrange the blocks in your drawer. Fill in the extra drawer space with snug-fitting pieces of ¼" hardboard, and use these traylike spaces for storing accessories.

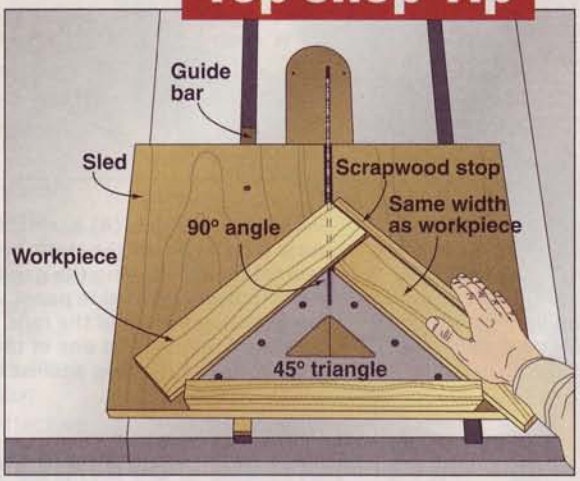


# Shop Tips

Helping you work faster, smarter, and safer

## Miter to picture-frame-perfect length the first time

**Top Shop Tip**

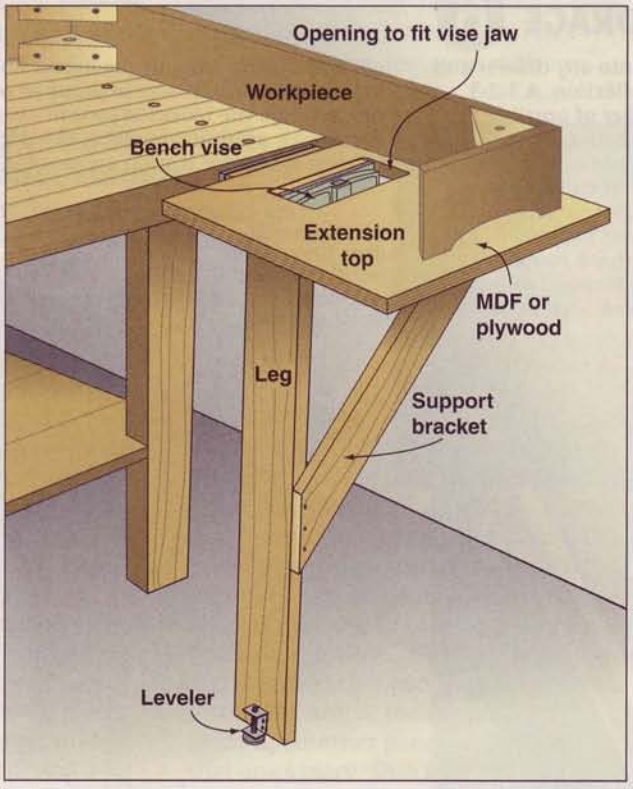



I've had great success cutting perfect miters for picture frames using a dedicated sled with a plastic 45° drafting triangle acting as a fence, as shown at *right*. After squaring the sled base to the guide bar, I cut a saw kerf two-thirds of the way through the sled. Next, I centered a fence a little shorter than the longest side of the triangle on the back edge of the sled. Finally, I screwed the triangle to the sled so that the point of its 90° angle splits the saw kerf.

To use the sled, I first crosscut all my frame sides to finished length—plus ⅛" to account for the kerf of my tablesaw blade. Then, I cut a scrap of stock the same width as the frame workpiece and hold a scrapwood stop against it as shown. With the workpiece butted against the stop, the blade removes half of the ⅛" excess length with each cut. It's as easy to cut on the right side of the blade as it is the left with no adjustments like you would have on a mitersaw.

*—Niki Avrahami, Garwolin, Poland*

## Workbench expansion gives you a leg up




I was building a corner cabinet when I realized my workbench wasn't quite wide enough for the project. To solve the problem, I enlisted my bench vise to create a temporary workbench addition, as shown.

The extension top is a separate, compact table that's quickly but firmly held in place by the vise. To install it, I first use the bench vise to align the surface of the extension flush with the benchtop. Then I use the leveler on the bottom of the leg to firmly position the rest of the extension and take some of the pressure off the vise.

*—Dave Wywial, Janesville, Wis.*

*continued on page 17*

## The Top Tipster

Photo: Pawel Zak

His face may not ring a bell, but if you frequent our Top Shop Tips forum (woodmagazine.com/tipsforum), you will certainly recognize his name: Niki Avrahami. Born in Bulgaria, this prolific tip-poster now lives in Poland with his wife, Regina. "She asked me to build a tissue box, and that's how I got 'infected' with the disease called woodworking," he says. "Doctors told me that the only cure is another router or tool." Take one of these, Niki, and call us in the morning.

Niki's Top Shop Tip earned him a Fein MultiMaster kit worth $390. Attaboy!

## Top tips earn tools!

Tell us how you've solved a workshop stumper, and if we print it, you'll get $100 and a copy of *450+ Great Shop Tips*. And, if your idea garners Top Shop Tip honors, we'll also reward you with a tool prize worth at least $250.

Send your best ideas, along with photos or drawings and your daytime phone number, to: **Shop Tips, WOOD Magazine, 1716 Locust St., LS-221, Des Moines, IA 50309-3023**. Or, by e-mail: shoptips@woodmagazine.com. Include your contact info in the e-mail as well.

Because we try to publish original tips, please send your tips only to *WOOD*® magazine. Sorry, submitted materials can't be returned.

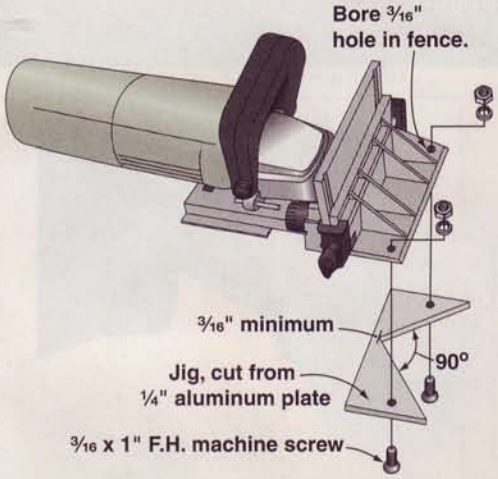
## Lucy, you've got some splinin' to do

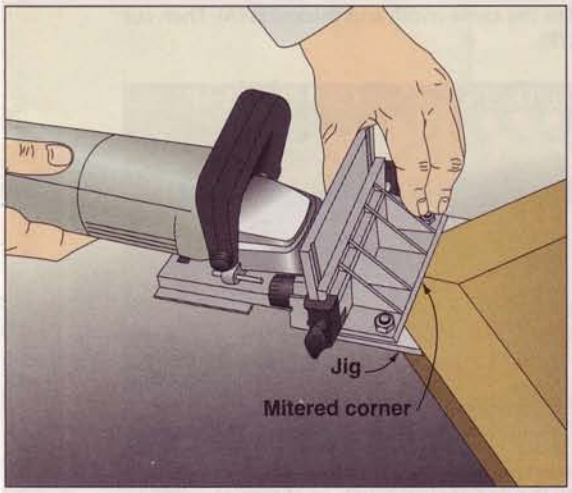
Miter joints are some of the weakest in woodworking because of poor end-grain to end-grain gluing. That's why I always reinforce my miter joints with a spline. I used to cut the spline slots with a jig on my tablesaw, but that gets awkward with a large frame.

Recently, I began using my biscuit joiner to simplify this process. By adding an aluminum plate to the jointer's fence, as shown, the slot is automatically centered on the joint. I cut the added plate to shape using a metal-cutting blade on my bandsaw.

A couple of caveats: When cutting the 90° bird's mouth, leave at least 3/16" of metal at the back of the plate for strength. And remember that you could accidentally cut into the added plate with the joiner's blade if you don't properly adjust the depth.

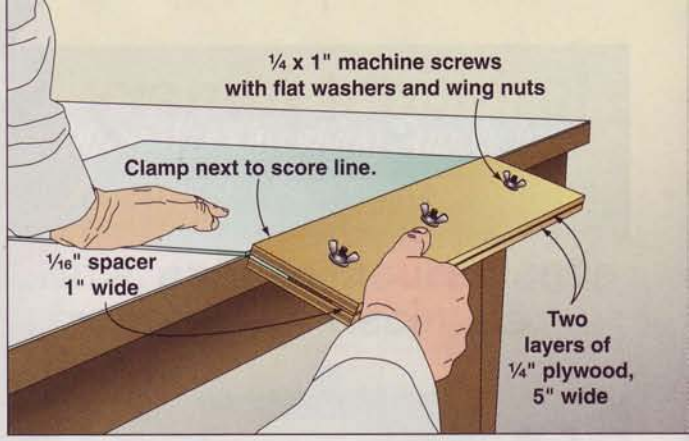
*—Jack Williams, Elephant Butte, N.M.*




## Snap a sharp line in glass

Having four daughters and three grandchildren, I am forever making picture frames. Usually these frames are not a common size, so I started to cut my own glass with mixed results. Finally, I made the glass-breaking jig shown *right* to provide uniform pressure for a clean break. On one of the plywood layers, I glued a 1/16×1" scrap of plastic countertop laminate.




To use the jig, clamp it over the glass sheet, leaving just enough room for the glass cutter. After scoring, reclamp it next to the score line, and snap off the extra glass.

*—Karl Mueller, Fairport, N.Y.*


PROUD OF WHAT YOU MAKE?

US, TOO.

Introducing

WORK SHARP
The Wood Tool Sharpener

NEW from the makers of Drill Doctor

Cutting Edge Technology for Woodworkers

Take a look at our latest project. It's the result of years of work, listening to woodworkers like you, and then building the wood tool sharpener that you wanted. Take a tour of the features and see what you think:

150mm Tempered Glass Grinding Wheel— provides an always flat and true, maintenance-free grinding surface on which to adhere PSA Abrasives

580 rpm wheel speed— Powerful 1/5 HP Motor

Sharpening Port Lapping Surface— "plunge-pull" sharpening technique and Sharpening Port abrasive increases burr removal and speeds sharpening

Sharpening Port— enables precise and repeatable angles of 20°, 25°, 30°, and 35° for chisels and plane irons up to 2" wide

Dry Cooling System— routed airflow and heat sink system keeps tools cool without the mess of a wet system

5-STAR BEST RATING WOOD MAGAZINE 2007

AWFS 2007 WINNER SEQUOIA AWARDS

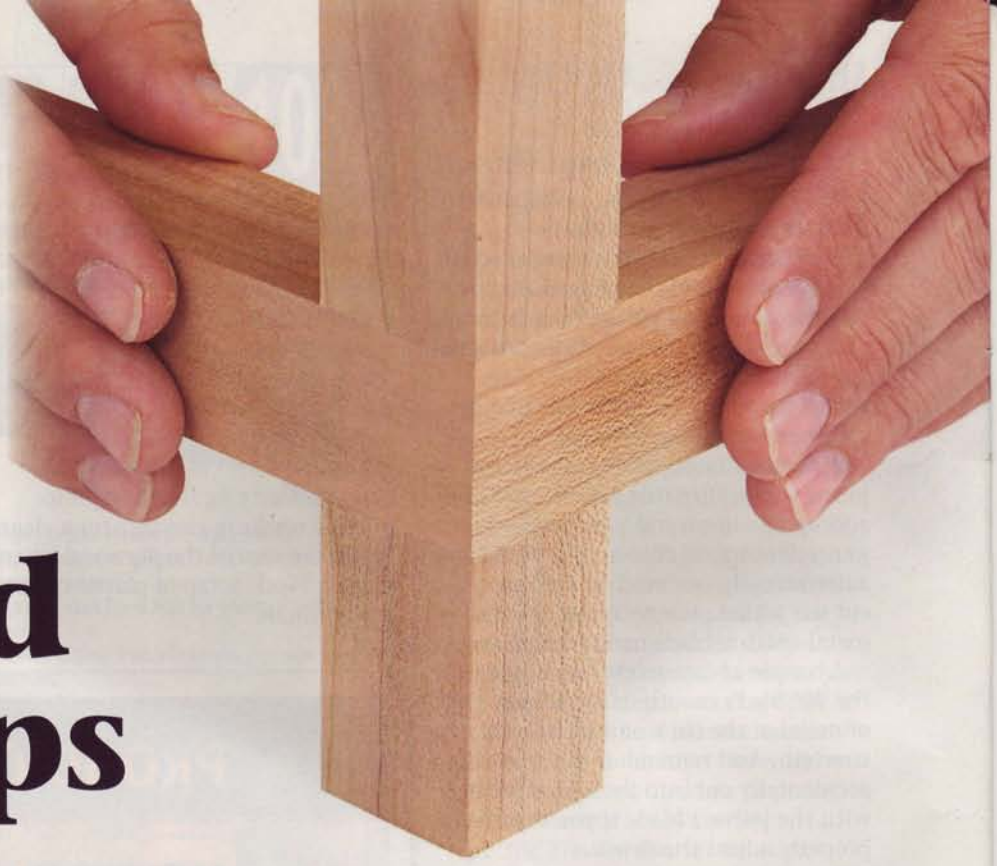
TWO FULL YEAR WARRANTY

Learn more about the award-winning Work Sharp at
www.worksharptools.com
or call 1-800-597-6170

Ask for it at Rockler, Woodcraft, and wherever you buy your tools.

Innovative Edge-Vision™ Slotted Wheel lets you see the cutting edge as you sharpen!

Circle No. 1655



# 3-way mitered half-laps

Combine the flowing grain of a miter joint with the strength of a half-lap using only your tablesaw.

Accuracy is important to making this joint, so before machining your stock, double-check and adjust your tablesaw blade to make it square with the tabletop. Then adjust your jointer's fence dead-on square with its bed.

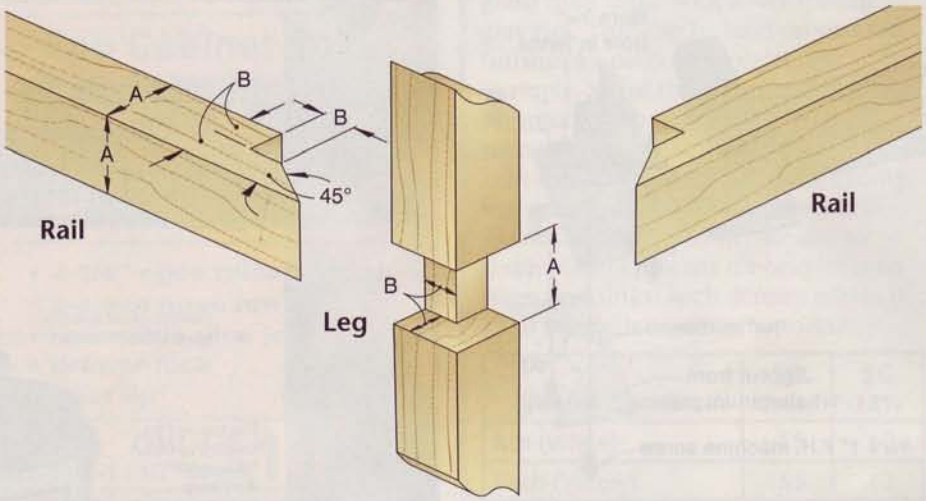
For the tables on *page 60*, we made all the legs and two sets of rails the same width and thickness. To begin, machine the legs and rail pieces to the same width and thickness before cutting the pieces to length. Save the cut-offs to test your dado-blade height. Cut 45° miters on the ends of each rail without reducing its length.

Next, using a dado stack that's a hair wider than half the width of the project parts, make test cuts in the cut-off scraps until the blade cuts half the part thickness, as shown at *right*. Lock the saw's blade height to prevent slipping.

Now you're ready to begin cutting the joints, starting with the legs.

*continued on page 20*

**ANATOMY OF A MITERED HALF-LAP JOINT**

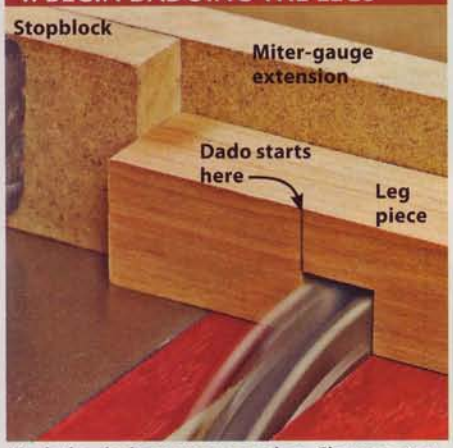



**For a tight joint, start with stock that's machined to the same width and thickness (A). Then cut dadoes that equal half the thickness of the stock (B).**

**RAISE THE DADO BLADE HEIGHT UNTIL THERE'S A NO-GAP OVERLAP**

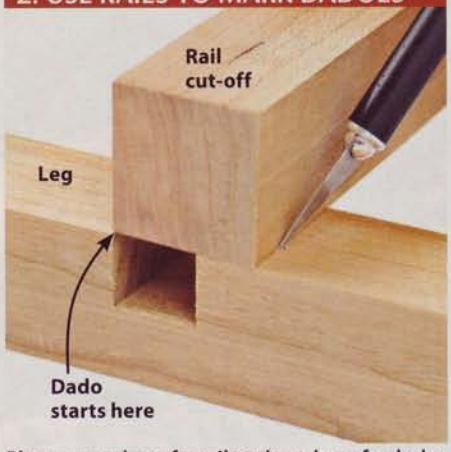
**To test dado-blade height settings for this joint, use two pieces of scrap the same thickness and width as your parts. Then raise the blade until the dadoes just touch, as shown at *right*.**

## 1. BEGIN DADOING THE LEGS



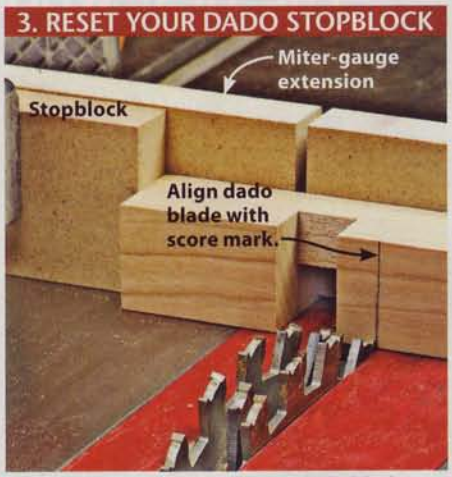

Mark the dado start on one leg. Clamp a stopblock to a miter-gauge extension, and make dadoes on two adjacent faces of each leg.

## 2. USE RAILS TO MARK DADOES



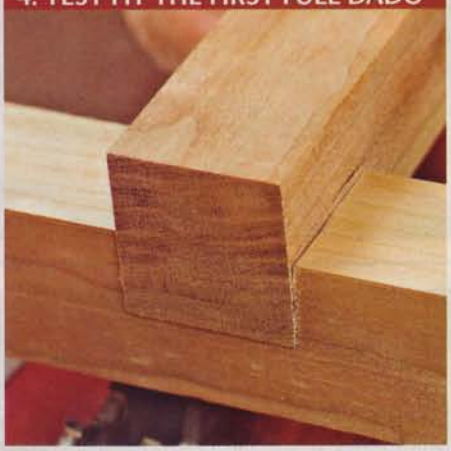

Place one edge of a rail at the edge of a dado on one of the legs. Then use a crafts knife to mark the other edge of the dado.

## 3. RESET YOUR DADO STOPBLOCK



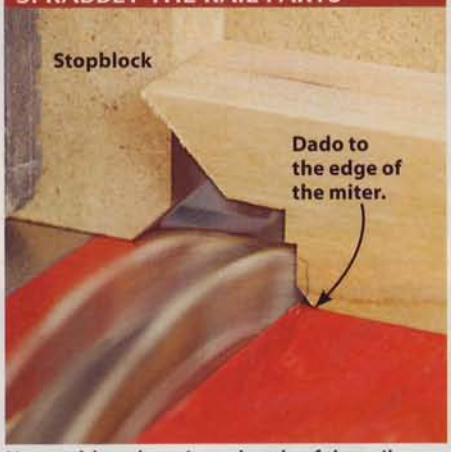

Align the score mark with the dado blade, and reposition the stopblock. Rotate the workpiece, dado down, and cut the other half of the dado on the two adjoining faces.

## 4. TEST FIT THE FIRST FULL DADO



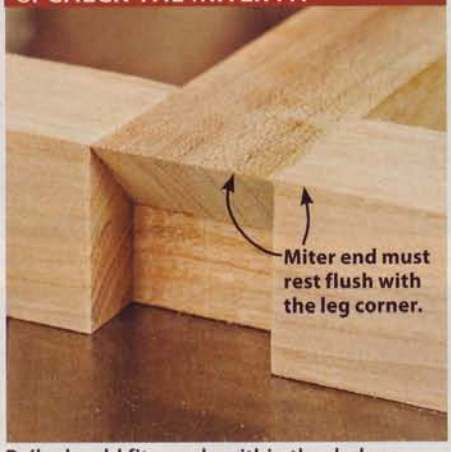
Use cut-off scrap to test the fit before making the remaining cuts on each leg.

## 5. RABBET THE RAIL PARTS




Now, rabbet the mitered ends of the rails. Gradually reposition a stopblock until you rabbet to the edge of the miter. Cut identical rabbets on both ends of each apron part.

## 6. CHECK THE MITER FIT

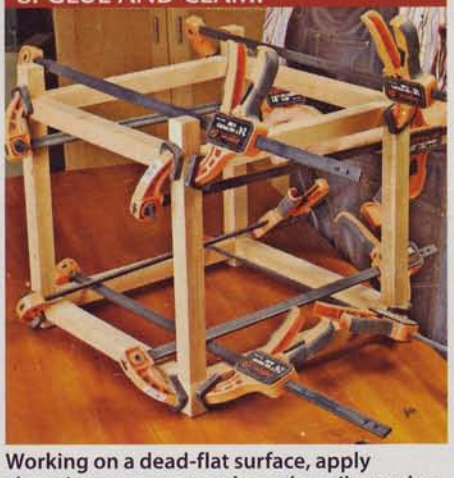



Rails should fit snugly within the dadoes, with the mitered end flush with the corner of the table leg. If they don't fit, you'll need to adjust the joint using a sanding block, as shown in the next step.

## 7. SAND TO FINE-TUNE JOINTS

Test-fit the rail parts in the leg dadoes. If the faces aren't flush, gently sand the rail rabbet with a 100-grit sanding block with abrasive on just one surface.

## 8. GLUE AND CLAMP



Working on a dead-flat surface, apply clamping pressure to where the rails overlap the legs. Check for square at each joint and that all four legs touch the surface. Allow the glue-up to dry for at least four hours.

## 9. SAND PIECES FLUSH

Using a random-orbit sander to avoid cross-grain scratches, sand the rails and legs flush up to 180 grit. Avoid accidentally rounding over the edges and corners. Hand-sand inside corners to 180 grit.

# Wise Buys

## Our Experts Test
# Dust-Collector Remote Controls

### Why buy?
You've probably more than once made a quick cut at your tablesaw or jointed an edge without turning on your dust collector, just to avoid walking across the shop to turn on the collector. That's where a radio-frequency remote controller comes in handy, enabling you to switch a dust collector on and off from anywhere in the shop. That increases your working efficiency, and, hopefully, ensures good health. Here are four great remote options, all costing $60 or less.

## SHOP FOX, D3038

**110-volt model (shown), $45**
**220-volt model #D3346, $40**

### Editor test-drive:
In my crowded basement shop I have to bob and weave across the room just to get to the dust collector. Then I have to bend and reach over the blower to flip the switch, which is mounted about 16" off the floor. It's terribly inconvenient. Now I use a Shop Fox remote to turn it on from anywhere in the shop. It even works from two rooms away despite dividing walls. I especially like that it comes with two remotes, but did not like the dangly clips because every time I reached for the remote I had to spin the unit to find the switch. Instead, I removed the clips and applied hook-and-loop patches to one unit as well as my tablesaw's rip fence, so it's always within reach. I attached a metal disc to the other so it grabs onto a magnetic belt clip.

*—Tested by Jan Svec, Projects Editor*

**To learn more:**
800-840-8420; shopfox.biz

## PENN STATE LONG RANGER III, LR110-3

**110-volt model (shown), $60**
**220-volt model #LR220-3, $70**

### Editor test-drive:
My dust collector is really loud, so I don't like to leave it running. That soon became a lazy, messy habit as I found myself not using it often enough unless machining a lot of stock. Now with the Long Ranger remote I use my collector every time I fire up a machine. Turns out, the remote doesn't have to be pointed directly at the wall unit as with my TV remote. It worked consistently from inside the house, through walls, out in the pole barn, and—because I wanted to see just how "long range" it really is—from my driveway 330' away. You can buy a second remote ($20) that's reprogrammable for the same controller.

*—Tested by Kevin Boyle, Senior Design Editor*

**To learn more:**
800-377-7297; pennstateind.com

## FERNBROOK SMART SWITCH, DK2202XT

**110-volt model #DK1101XT, $43**
**220-volt model (shown), $50**

### Editor test-drive:
With the Fernbrook system a single remote controls both the dust collector and air-filtration unit. For $50 the basic unit controls the dust collector; to add air-filtration control (or even an exhaust fan) you need to buy an accessory 110-volt outlet for single-speed machines (like mine) or a toggle switch—that replaces your outlet—for variable-speed air cleaners ($30–$40 each). With the latter, you can then control the air cleaner's speed with the remote as well. I hooked up my 220-volt collector to the Smart Switch and had it running in just a few minutes. For the air cleaner I had to replace a wall outlet with the RM1102 Relay Module—essentially just changing outlets. Now I run both machines whenever necessary, for as long as required, with just a touch on the remote. And, it even works from up to 200' away.

*—Tested by Pat Lowry, Technical Consultant*

**To learn more:**
800-382-1924; dnet.net/frnbrook

## LONG RANGER MULTIGATE SYSTEM, LRMSET220

**110-volt model #LRMSET110, $50**
**220-volt model (shown), $60**

### Editor test-drive:
I've had a remote control on my 3-hp dust collector for years, but—just like with the TV in my living room—the remote often comes up missing. With Penn State's MultiGate System there's no need for a remote because the metal blast gates turn the collector on and off when I open and close them, something to be done anyway. It took about two hours to install the control unit and five gates and connect them with 22-gauge wire. It's really simple, even if you don't do much electrical work. I like that the gates have an open slot, so they push stray chips out the back upon closing rather than causing the gate to jam. The base system comes with the relay box, one gate, and 100' of wire. Extra gates cost only $11 each, and an extra 100' of wire costs $10.

*—Tested by Randy Zimmerman, Technical Consultant*

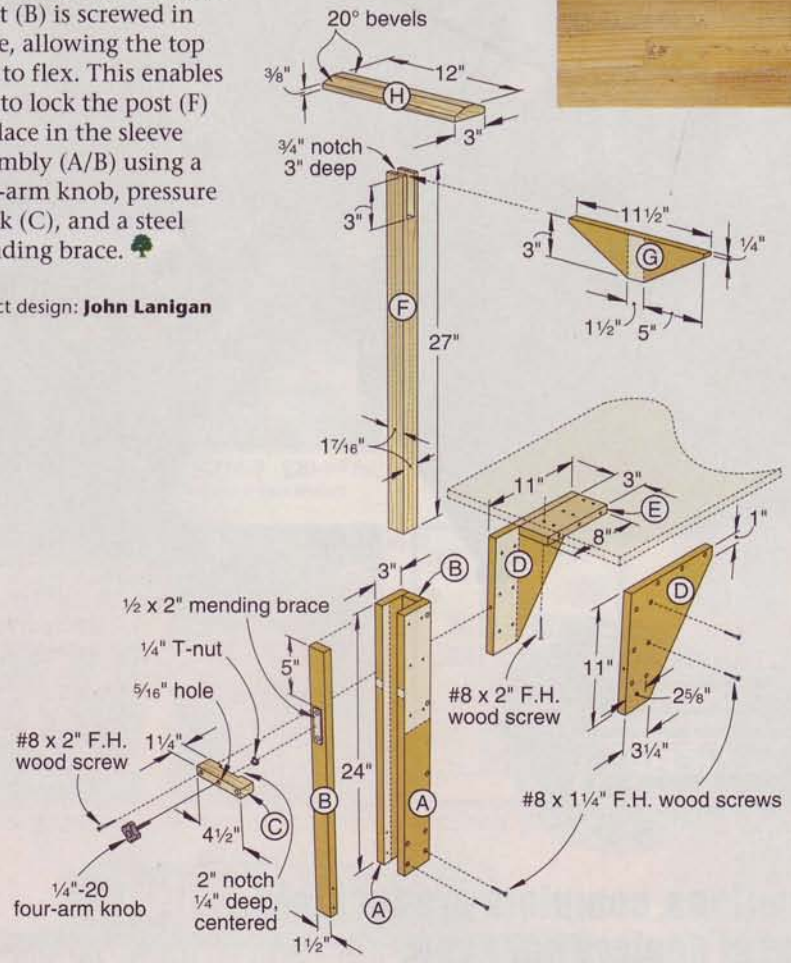
**To learn more:**
800-377-7297; pennstateind.com

# Right-Height Outfeed Support

Here's a rock-solid solution to stock support, sent in by *WOOD*® magazine reader John Lanigan, of Concord, New Hampshire. Mount it to a workbench, as shown, or add legs for a stand-alone support. Easy height adjustability makes it a versatile addition to your shop.

We used ¾" MDF for most of the construction and laminated two pieces of ¾"-thick stock to form the movable post (F). The beveled support pad (H) allows stock to move over it with ease. When assembling the unit, note that only the bottom end of the sleeve front (B) is screwed in place, allowing the top of B to flex. This enables you to lock the post (F) in place in the sleeve assembly (A/B) using a four-arm knob, pressure block (C), and a steel mending brace.

Project design: **John Lanigan**




## Materials List

| Part | | FINISHED SIZE T | W | L | Matl. | Qty. |
|---|---|---|---|---|---|---|
| A | sleeve sides | ¾" | 3" | 24" | MDF | 2 |
| B | sleeve front/back | ¾" | 1½" | 24" | MDF | 2 |
| C | pressure block | ¾" | 1¼" | 4½" | P | 1 |
| D | bottom braces | ¾" | 11" | 11" | MDF | 2 |
| E | bottom bracket | ¾" | 3" | 8" | MDF | 1 |
| F | post | 1⁷⁄₁₆" | 1⁷⁄₁₆" | 27" | P | 1 |
| G | upper brace | ¾" | 3" | 11½" | MDF | 1 |
| H | support pad | ¾" | 3" | 12" | P | 1 |

**Materials key:** MDF–medium-density fiberboard, P–pine.
**Supplies:** #8×1¼" flathead wood screws, #8×2" flathead wood screws, ¼"-20 four-arm knob (1), ¼" T-nut (1), ½×2" mending brace National N114-314 (1).

Find dozens of FREE project plans at
woodmagazine.com/freeplans

# Zero (Chip-Out) Tolerance

Don't accept workpiece chip-out on your tablesaw. Instead, eliminate it by using a zero-clearance insert for every cut you make.

Watch a FREE video on zero-clearance inserts at woodmagazine.com/zcivideo

Anyone who's ever crosscut oak plywood knows how face-grain chip-out can ruin an edge. Once the damage is done, you're forced to either fill those voids or accept the flaws on your project.

But you don't have to live with chip-out. A shop-made zero-clearance insert replaces your tablesaw's factory-supplied throat plate—and its wide gap that allows unsupported wood fibers to tear away during a cut. Because you cut the blade slot with the blade you're using, the zero-clearance insert fully supports the fibers.

It's a good idea to use an insert for every blade and every cut you make. Plowing a ¾"-wide dado? Use a custom-fitting insert to stop chip-out. How about a ½" dado? Make another insert. Cutting a 30° bevel? Get an insert just for that. You can easily make insert plates, so cut out a dozen blanks and keep them handy for every time you change blades or bevel angles. After using an insert for a specific setup, mark it with that setting (and blade) and save it so you'll have it for the next time you make the same cut.

## How to make inserts fast

You can buy pricey, premade phenolic inserts, but we like to make our own zero-clearance inserts from ⅜- or ½"-thick Baltic birch plywood. This stable material proves strong, and doesn't have voids between plies. Medium-density fiberboard (MDF) also makes a good insert, but lacks the strength of plywood. Hardwoods, although strong, can shrink or swell with seasonal changes in humidity, and don't work as well as plywood.

With a pattern bit installed in your router table, use your saw's original insert to make duplicates. Some insert plates have antilift tongues [**Photo A**] or lateral-adjustment screws—with these you need to create a pattern to use for making copies. To do this, trace your insert plate onto a blank of plywood or MDF, smoothing the tongue or screw areas. Cut close to the line at your bandsaw, and then sand the pattern until it fits snugly into your saw's throat. If you want the antilift benefit of the tongue, you can add this to your inserts by cutting a groove on the bottom side and then gluing in a thin strip of hardwood that protrudes under the tabletop.

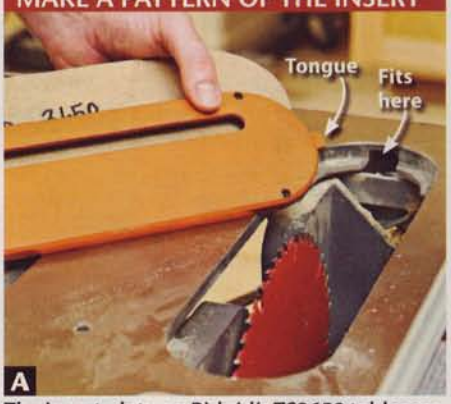
Cut out rectangular plywood blanks slightly larger than the pattern. Using cloth-backed, double-faced tape, secure the blank to the pattern, and then bandsaw to within ⅛" of the pattern. Next, rout the blanks to shape using a pattern bit or flush-trim bit in your router table [**Photo B**].

## Customize the inserts to fit your tablesaw

Now that you have the blanks cut to shape, make a finger hole (for removing the insert) by drilling a ¾" hole through each insert. Keep it at least 1" to the side of where the blade will project through the insert.

*continued on page 30*

MAKE A PATTERN OF THE INSERT




**The insert plate on Ridgid's TS3650 tablesaw has a tongue on the outfeed end that slips under the tabletop and into a pocket to prevent lifting during a cut.**

FLUSH-TRIM BLANKS TO PATTERN

**If your bit is long enough, you can rout two inserts at a time by double-face taping them together, and then to the pattern.**

On many saws with 10" blades, the blade retracts only ¼" or so below the table surface [**Photo C**], meaning your unkerfed insert blank won't sit flush with the tabletop. You've got three options here: First, use a smaller diameter blade—like one of the outer blades from your stacked dado set, or a blade from your portable circular saw—to cut a relief slot that your 10" blade will fit into. (Unless the blade you use has the same kerf width as your 10" blade, don't raise it high enough to break through the surface.)

Your second option is to adhere the blank onto the metal insert plate, clamp it in place, and then slowly raise your spinning 10" blade until it just pokes through the plywood blank [**Photo D**]. Now separate the two plates and install the zero-clearance insert over the blade.

With option #3, rout a ¼" channel along the bottom of the insert deep enough to give the blade initial clearance [**Photo E**] when you place it in the saw. However, do not rout deeper than half the thickness of the insert. More than half would weaken it and create a potential safety hazard.

You'll also have to cut relief holes or slots for blade guards, splitters, or riving knives. You can do this with your tablesaw and 10" blade—with the original insert installed—if the relief exits the back of the insert. If it does not, use a jigsaw [**Photo F**]. You might also have to relieve the bottom face for such things as the arbor assembly and flange, or for parts specific to the original insert [**Photo G**]. Machine these shallow relief areas at the drill press with a Forstner bit or on a router table.

## Now level the insert with the tablesaw top

If your insert sits too high, drill or rout relief areas on the bottom where it sits on the throat tabs or rabbet. If your insert sits too low, add leveling screws so you can adjust the fit perfectly from the top. (Use either setscrews or machine screws.) To do this, either transfer the screw locations from the original insert, or use thumbtacks to mark them [**Photo H**]. Now drill shank holes, and countersink or counterbore on the top face. Add the screws [**Photo I**] and then raise or lower them to make the insert flush [**Photo J**].

### CHECK THE BLADE DEPTH

C

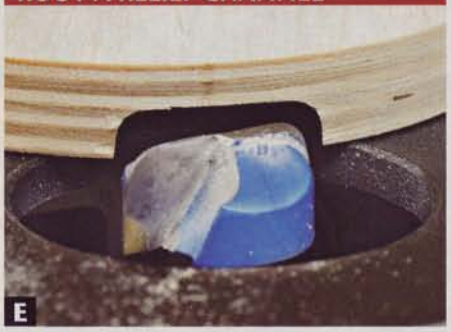
With this steel rule resting on the insert ledges, you can see that the 10" blade requires a relief cut in a blank insert.

### PRECUT THE BLADE KERF

D

Because the insert rests on top of the saw, secure it firmly with double-faced tape and a board and clamps.

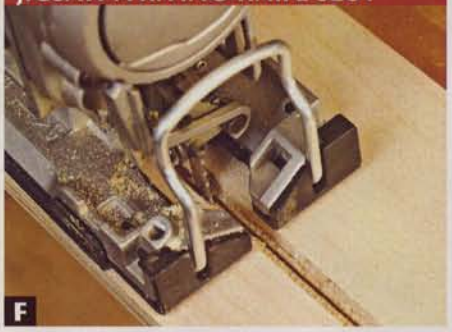
### ROUT A RELIEF CHANNEL



E

Use any bit that can rout a channel. We used this dish-carving bit to create a ¾"-wide relief necessary for a 45° bevel cut insert.

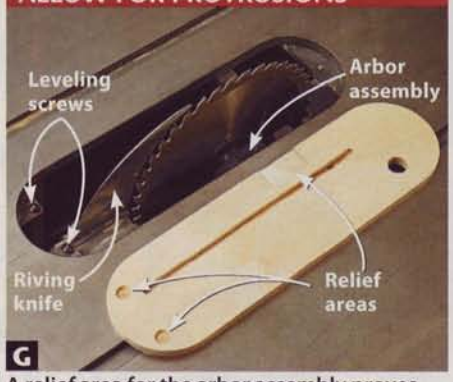
### JIGSAW A RIVING-KNIFE SLOT



F

After making a relief cut with a ¼"-diameter router bit, we used a jigsaw to create clearance for the riving knife.

### ALLOW FOR PROTRUSIONS




G

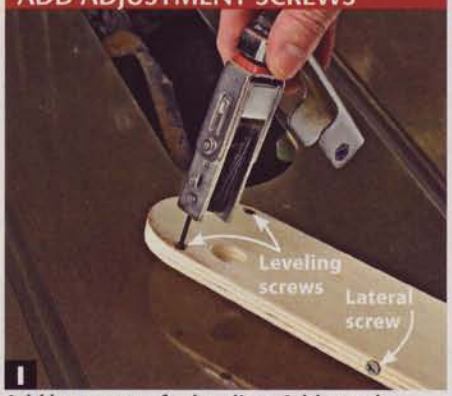
A relief area for the arbor assembly proves necessary when raising the blade to cut 2" or thicker workpieces.

### MARK SCREW LOCATIONS EASILY

H

Place thumbtacks onto the ledges, and then gently lower the insert into place. Tap it lightly to make indentations.

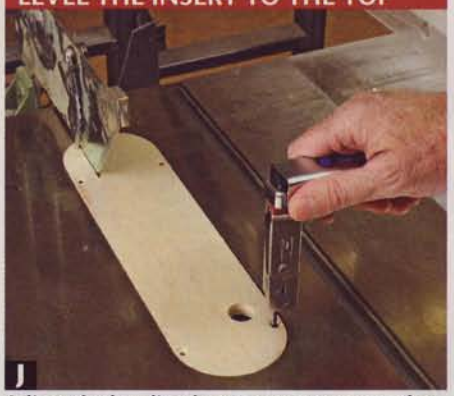
### ADD ADJUSTMENT SCREWS




I

Add hex screws for leveling. Add wood screws to one edge and end for lateral adjustments if the insert is too loose.

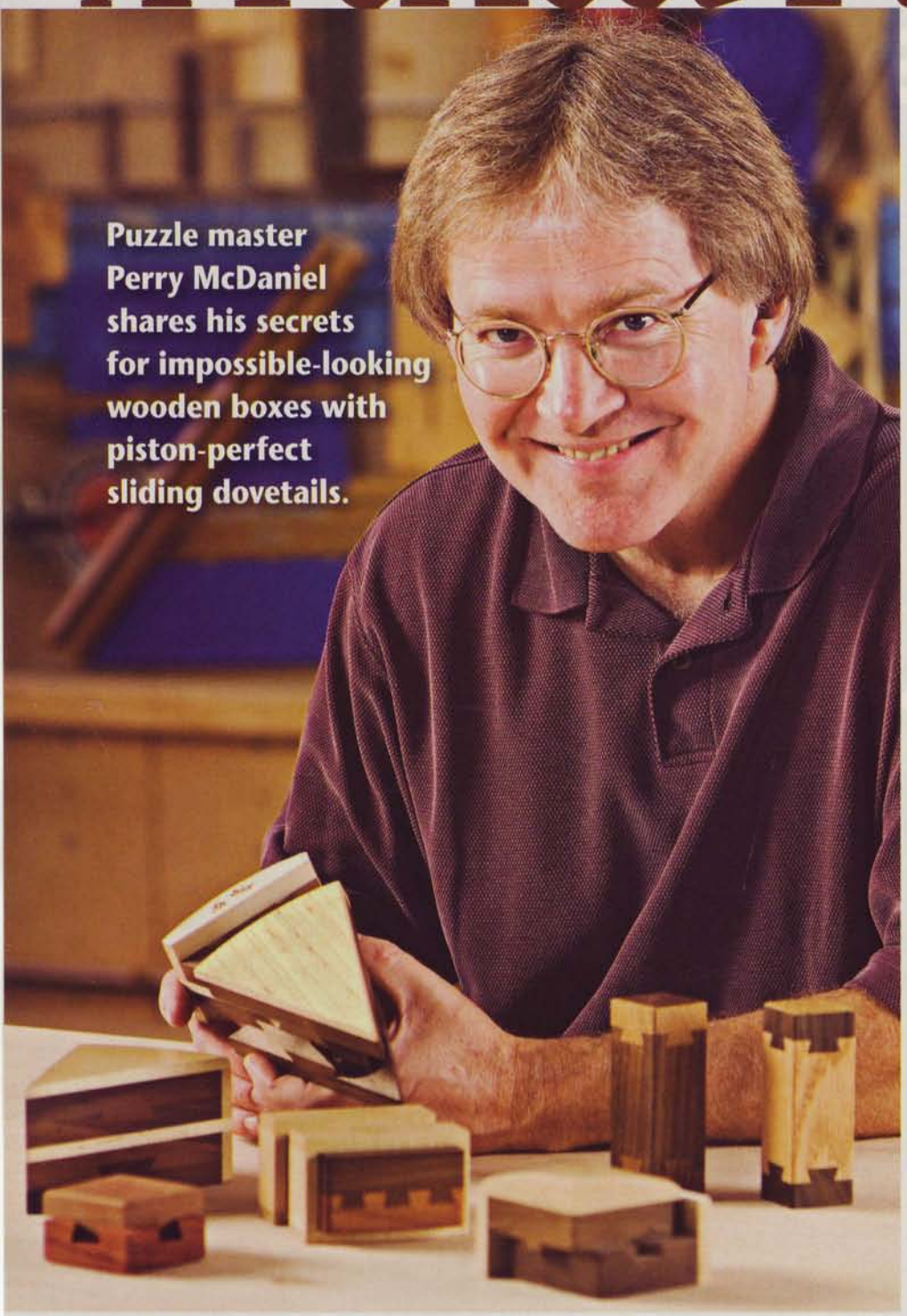
### LEVEL THE INSERT TO THE TOP



J

Adjust the leveling hex screws to ensure the insert sits flush with the tablesaw's top. If it sits too high your workpieces will catch on it.

# A Perfect Puzzler



**Puzzle master Perry McDaniel shares his secrets for impossible-looking wooden boxes with piston-perfect sliding dovetails.**

Perry McDaniel shows a few of his puzzling creations. It's hard to find another project that can offer so much delight (and frustration) and uses so little wood.

The ancient Egyptians might have been the first to use the dovetail, but present-day Texan Perry McDaniel has definitely given this old woodworking joint a few new twists. Working in his garage shop, he has designed more than 35 original wooden puzzles. (Factoring in several production runs, Perry estimates that he's built more than 4,500 boxes.) In fact, his work is stashed away in the private collections of puzzlers from all over the world.

One key to most of Perry's designs is the simple sliding dovetail. The super-tight dovetails that have become his trademark look impossible to make, but they're not. In fact, once you know a few basic rules, you'll discover that the impossible is not only possible, but surprisingly simple.

Building two of Perry's own custom puzzles, you'll learn two different ways to rout perfectly fitting dovetails. In addition, you'll master two clever magnetic locking mechanisms that can be adapted to fit other boxes or drawers.

## Perry's 4 rules for super-tight sliders

Although they differ in design and complexity, Perry's puzzles obey a few simple rules. Following these guidelines not only ensures smooth-sliding dovetails, it also helps you avoid wood-movement woes whenever you're working with gnat's-backside tolerances.

***Rule 1: Start with stable wood.*** Perry likes using contrasting species of wood, but sticks with the most dimensionally stable species, such as walnut, mahogany, and padauk. "Steer clear of maple and oak," he says. "As soon as the humidity changes, even a little, your project is likely to stick—and stay stuck."

***Rule 2: It's safer to go small-scale.*** "Even the best wood will expand and contract a little," he says. When aiming for a seamless fit that's sure to slide in any season, Perry keeps his projects on the small side. Most of his designs use dovetailed slides shorter than 6".

***Rule 3: Prep work must be precise.*** Absolute flatness is essential for a smooth-sliding dovetail joint. To check for flat, press the boards together after jointing both faces. "If they're both really flat, you'll feel a little suction when you pull them apart."

***Rule 4: Use a thin film finish.*** "Oil-based finishes sink into the wood, swell the fibers, and can freeze up a previously perfect joint," he says. Instead, Perry sprays his puzzles with two light coats of shellac. The super-thin film finish enhances the color of the wood and seals the surface from absorbing moisture. "Avoid wax," he warns. "Although it's slick in some instances, when used in a sliding dovetail, wax tends to stick." Fortunately, Perry's found a slippery substitute: "A spritz of a dry tool lubricant, such as TopCote, does the trick." ($13, no. 97594 at Rockler, 800-279-4441, or rockler.com)

Caged Dove—closed

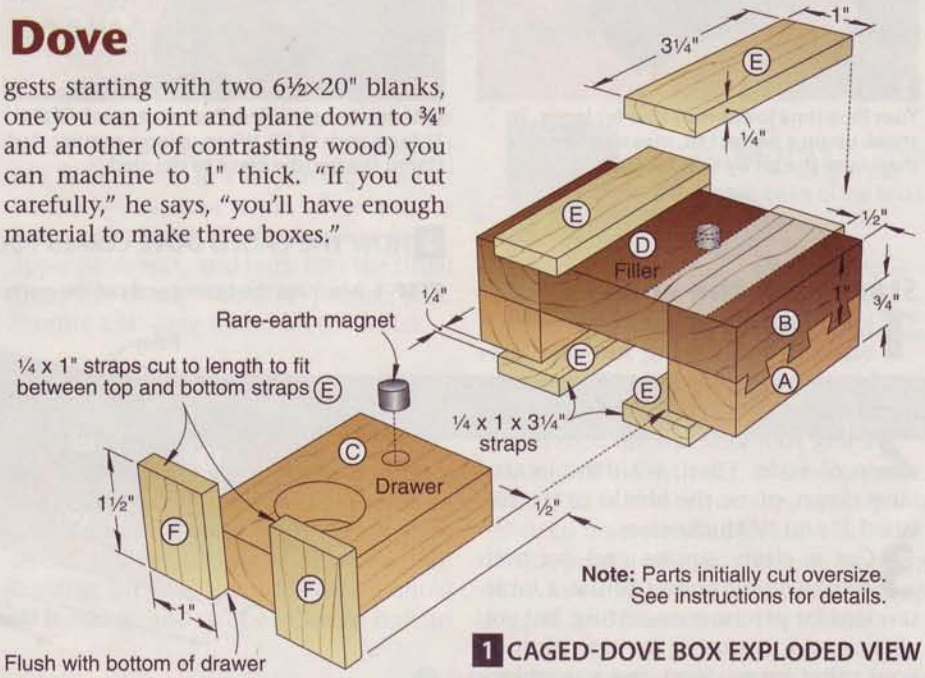
Caged Dove—open

To keep track of the jointer-flattened faces, mark the jointed edges as shown. Orient the X'd edges against the machines' fences for all later steps.

# Building the Caged Dove

To help you make a puzzling project, Perry designed this box exclusively for *WOOD*® magazine readers. You'll try your hand at cutting sliding dovetails with your router, but you'll be able to complete this fun puzzler even if your joinery isn't perfect. That's because Perry designed the dovetailed ends to look like they're supposed to slide. Instead, the drawer slides open from one end [*above* and **Drawing 1**]. A pair of rare-earth magnets (one of Perry's favorite locks) holds the drawer closed and snaps it shut with a satisfying "click." First-time puzzle solvers are typically surprised to see how easy it is to open the box once they know its "secret."

You don't need much stock to start. For safe jointing and planing, Perry suggests starting with two 6½×20" blanks, one you can joint and plane down to ¾" and another (of contrasting wood) you can machine to 1" thick. "If you cut carefully," he says, "you'll have enough material to make three boxes."




**Note:** Parts initially cut oversize. See instructions for details.

**1** CAGED-DOVE BOX EXPLODED VIEW

## SHOP TIP

### Incremental positioning made simple

According to Perry, cutting perfect-fitting dovetails can be explained by a "dovetail formula:" Depth of Cut equals the Cut Diameter minus half the Cut Spacing; then divide that by the tangent of the Dovetail Angle. Whew! "But you don't really need to do a lot of math to figure out what works," he quickly adds. "The formula simply demonstrates that for each dovetail height, there's only one workable spacing." But what does it all mean where the bit hits the board? "By keeping one factor constant," he explains, "adjusting the other will achieve a perfect-fitting dovetail joint, every time."

For perfectly consistent spacing, Perry usually uses an incremental fence (see **Sources**), but for the Caged-Dove puzzle, he devised a three-board trick that provides the same degree of consistency and works with any router-table fence. In addition to a router table, you'll need a ½" 14°-degree dovetail bit, a pair of 7/16"-thick spacers, and a backstop as long as your router table is wide.

After establishing the first fence setting and locking the fence in place, insert spacers the same thickness as your dovetail spacing (7/16", in this case) and clamp on a backstop that traps the spacers against the fence [**Photo B**]. After making the first cut, remove the spacers and slide the fence against the backstop [**Photo C**], then make the first cut in the mating workpiece.

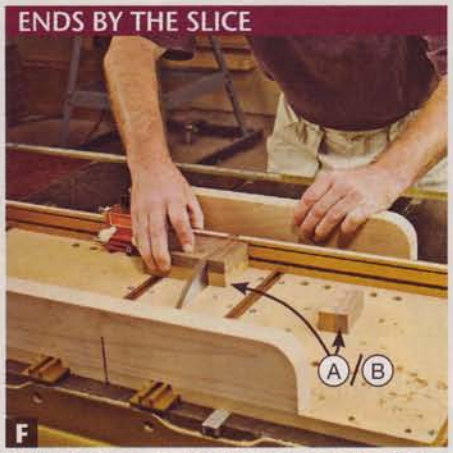
***Note:*** *You'll need to test and tweak the fit of the dovetails before routing your box. Practice project Steps 4–7 using scrap stock. Adjust the bit height as necessary before using good wood.*

**Start by routing a 5/16"-wide half-pin into part B. Use a pushblock to keep your fingers out of harm's way, and hold the wood against the fence.**

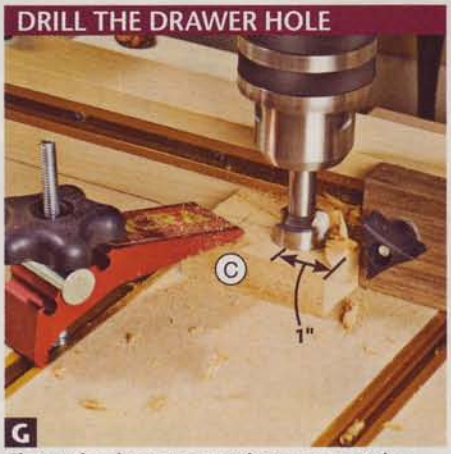
**Remove the spacers and move the fence tight against the backstop. Then rout a groove into part (A). (You'll shift the fence before routing each groove.)**

**If it looks like you're about to rout a wider groove, stop! This means that you've forgotten to either shift the fence or switch your pieces.**

Your first-time joints may be a bit loose. To sneak up on a perfect fit, measure the gap, then raise the bit by that amount.




With his crosscut sled, Perry cuts each of the 1"-long ends (A/B). When using a regular sled, clamp the narrow piece to the sled.




Clamp the drawer securely to prevent the small piece from spinning when the bit contacts the wood.

## Start with the ends

**1** Joint one face and an edge of each blank. After making sure the faces are "suction" flat (see Rule #3), mark the freshly jointed edges [**Photo A**].

**2** Using your tablesaw, rip both blanks to 6" wide. Then, with the jointed faces down, plane the blanks to the finished 1" and ¾" thicknesses.

**3** Cut a clean, square end on both blanks. Perry prefers to use a tablesaw sled for precise crosscutting, but you also can do this using an extension on your miter gauge. Next, use a stopblock to crosscut a 2¾"-long piece off each blank for forming the box ends (A/B) [**Drawing 2**]. Set aside the remaining blanks for now.

**4** At the router table, set a ½" dovetail bit just a hair less than ¼" high. Adjust the fence to cut about 5/16" into the edge of part B (at the widest part) [**Drawing 2a**], and then position the 7/16" spacers and backstop against the back of the router fence, as shown in the **Shop Tip** on the *previous page*. Rout the first dovetail groove.

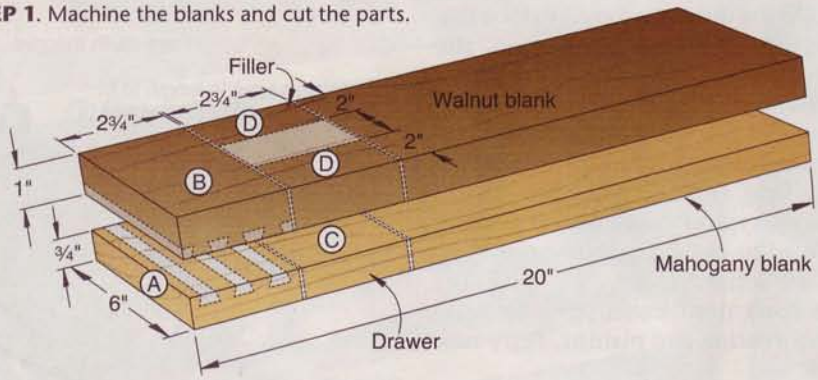
**5** Remove the 7/16" spacers and move the fence away from the bit until it butts against the backstop [**Photo C**]. Clamp the fence in place, and rout the first groove into part A.

**6** Reposition the spacers between the backstop and your router fence and continue shifting the fence each time you rout each new groove. After one or two cycles through **Shop Tip steps 1–3**, routing two tail grooves in each board, check the fit of your sliders. At this point, the dovetails may be slightly loose [**Photo E**]. Measure the gap, and raise the bit by that amount.

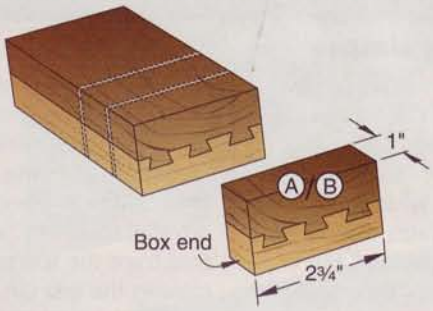
**7** Test-fit your freshly cut dovetails in parts A and B one last time before

### 2 HOW THE CAGED DOVE COMES TOGETHER

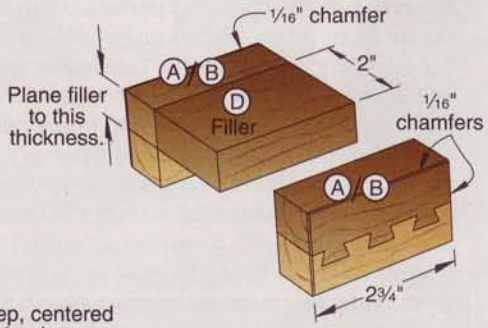
**STEP 1.** Machine the blanks and cut the parts.




**STEP 2.** Crosscut pieces for the box ends.

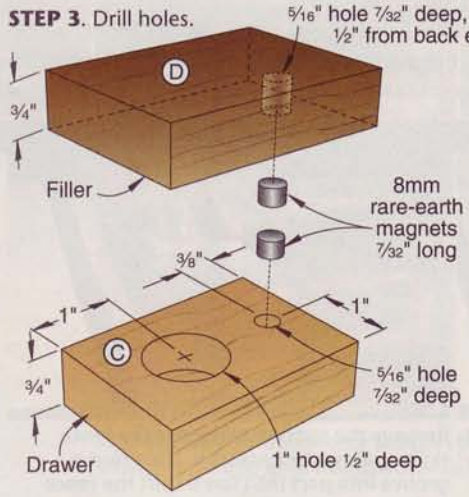



**STEP 4.** Build the basic box.

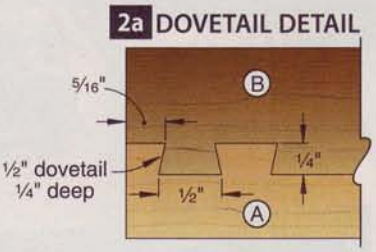


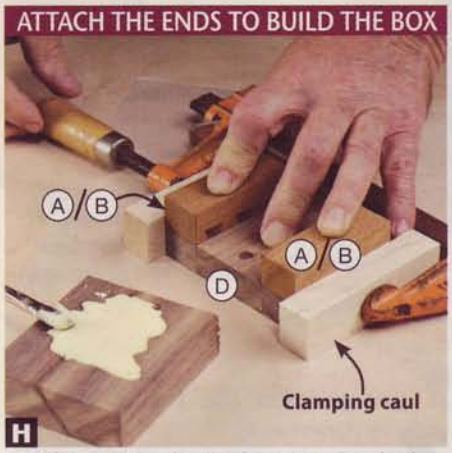

### 2b DRAWER DETAIL

**STEP 3.** Drill holes.

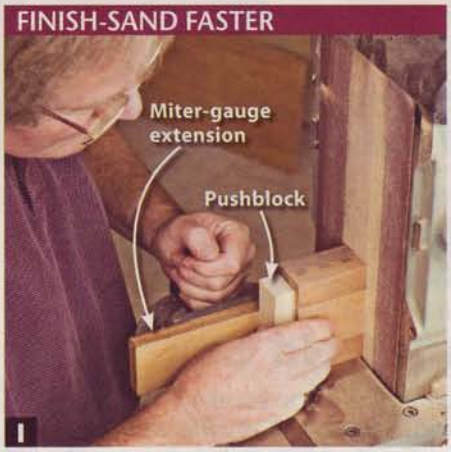



### 2a DOVETAIL DETAIL






Matching the end grain for a seamless look, glue the ends (A/B) to the filler (D). The cauls prevent the clamps from denting your work.




By using a miter gauge and pushblock with his belt sander, Perry quickly finish-sands the box while still keeping the edges square.

The gluing jig ensures that the top/bottom straps (E) offset the box ends equally. They overhang the front and back by at least ¼".

brushing on glue and sliding them together. Work quickly; the glue may swell the wood and prevent you from sliding the pieces together.

**8** Using your crosscut sled or miter gauge with extension, trim one end of the dovetailed blank to remove dried glue and any tear-out that might have happened while routing. Next, cut two 1" pieces for the ends (A/B) [**Photo F**]. (Tip: Saw a few extra pieces from this blank. Having bonus ends comes in handy if you make a mistake later on. If the project comes together goof-free, you can use those extra pairs to make more boxes.)

## Make the drawer with a dual-magnet lock

**1** Measure the thickness of part B on one of your ends (A/B), minus the length of the dovetails. Now, take the leftover 1"-thick blank that you set aside earlier and plane it to this thickness.

**2** To make the drawer (C) and filler (D) [**Drawings 1, 2b**], cut a 2¾×2" piece from each leftover blank.

**3** With a 1" Forstner bit in your drill press, bore the drawer cavity ½" deep and centered 1" from the front edge of the drawer (C) [**Photo G**].

**4** Flip the drawer (C) end-for-end and using a 5⁄16" Forstner bit, drill a hole centered ⅜" from the back edge and as deep as the rare-earth magnet is thick. (See **Sources**.) In the filler (D), bore another magnet hole the same size and depth centered ½" from the back edge. (Perry offsets the holes by ⅛" so the magnets hold the drawer in place.)

**5** Apply a drop of cyanoacrylate (CA) glue into each magnet hole, and then press the magnets into place. (Tip: Be sure to test the polarity of the magnets before you glue them in to make sure they attract. If you reverse the poles, the magnets will push the drawer open, rather than hold it shut!)

**6** Glue the ends (A/B) to the filler (D) [**Photo H**]. Remove any glue squeeze-out from the inside corners that might prevent the drawer from fitting well. After the glue has dried, test the snap-fit of your drawer, sanding its edges for a slightly loose fit.

**7** Using his belt sander, Perry finish-sands the ends and edges up to 220 grit. To keep the corners square, he uses a miter gauge equipped with an extension, and a pushblock [**Photo I**]. Hand-sand a 1⁄16" chamfer along the outside edges of the box ends with a sanding block and 220-grit paper.

## Now capture the dove in the cage

**1** Plane a piece of 1"-wide maple 22" long to ¼" thick.

**2** From this strip, cut four 3½" pieces for the top/bottom straps (E). (Perry cuts these overlong and then trims them after assembly.) Glue them to the top and bottom of the box, where dimensioned, using a gluing jig made from ½"-thick MDF [**Photo J, Drawing 3**]. Apply glue only to the part of the straps that contact the filler (D) and ends (A/B).

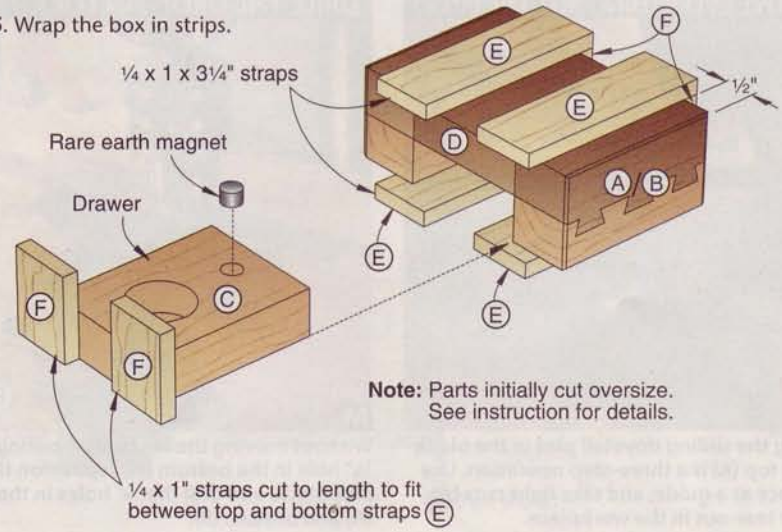
**3** Cut four 1½"-long front/back straps (F) to fit between the top and bottom straps. Glue the back straps first. Use glue sparingly to avoid squeeze-out. Allow the glue to dry before gluing the front straps to the front end of the drawer. (Tip: By inserting a strip of cardboard behind the drawer, the front end will protrude enough to help you apply adequate clamping pressure.)

**4** Using a belt sander, sand the ends of the top and bottom straps (E) flush with the front and back straps (F).

**5** After finish-sanding the straps, Perry finishes the box with two light coats of spray shellac.

### 3 ATTACHING THE STRIPS

**STEP 5.** Wrap the box in strips.



# Puzzle PLUS: The Sandfield Box

This baffling box started Perry down the puzzle pathway almost a decade ago. Based on a design patented in 1887, the finished joint looks impossible to make, until you see that the dovetails run *diagonally* through the box. To add to the mystery, Perry's puzzle employs a locking pin. This simple lock prevents persistent wigglers from uncovering this box's secret—until you tap the top to release the pin from the magnet.

This box isn't difficult to make, but the precise dovetail-bit positioning requires an incremental-positioning router table fence. (For an affordable incremental fence, see **Sources**.) Rather than attempting to juggle spacers, Perry uses the fence's positioning scale to "zero in" the bit after making the first cut, and then relies on the measurements on the fence to quickly and accurately position it for subsequent cuts.

As with the Caged-Dove puzzle, start with oversize blanks that you can joint and plane safely. Two 1×3½×20" blanks yield five or six boxes.

## Build the box

**1** Joint a face and one edge of each blank, and mark the jointed edge. Rip both blanks to 3" wide; then plane the unjointed face of the top blank to 1", and the bottom blank to ¾". (Tip: Rip an extra piece of ¾"-thick scrap to 3" to help center the bit in Step 3. Because the 20" sliding dovetails are sure to stick, Perry then crosscuts both blanks to a more manageable 10" long.)

**2** Install a ½" dovetail bit in your router table and set the cutter height just under ¼". Using two pieces of scrap, repeat the test-fitting steps described in Steps 4–7 (on *page 35*) of the Caged Dove puzzle to set your bit height. This time however, the process will go quicker because you can use the fence's scale to move the fence in 7/16" increments. Test your dovetails and raise the cutter as necessary for a tight fit.

**3** Position the fence to center a dovetail groove in the blank. To do this, measure to the center of the extra piece that you cut in Step 1, adjust your fence, and rout a groove through the board. Now, turn the board end for end and rout the groove again. Unless you're perfect, the finished groove will wind up being slightly wider than the bit [**Photo K**]. Adjust the fence to center the bit in the groove by eye, and slide the fence scale so it reads 1½" under the cursor.

**4** Set your incremental fence to ¾", and rout the first dovetail groove in the blank for the bottom (B). Then reset to 2¼" and cut the second dovetail groove [**Drawing 4**].

**5** Routing the blank for the top (A) is almost as easy as the bottom. In this case, you'll remove much more material, leaving only the long dovetail pins that fit the grooves you cut in Step 4. Start by setting the fence so the dovetail bit lightly scores the edge of the blank; then move the fence and make two or three progressively deeper passes until the fence reads 5/16". Reposition the fence to 1 3/16", rout a dovetail groove, keep moving the fence, and progressively rout out the waste until the fence reads 1 13/16" [**Photo L**]. Finally, move the fence to 2 11/16", and rout the far edge.

**6** Slide the resulting dovetail pieces together and crosscut the assembly into 3" long blanks. You'll notice that the dovetail fit loosens slightly once the length if reduced (per Perry's Rule #2).

## Make the drawer with the drop-pin lock

**1** Using a ⅞" Forstner bit in your drill press, bore a hole ½" deep for the treasure compartment in the bottom (B), where shown [**Drawing 4**].

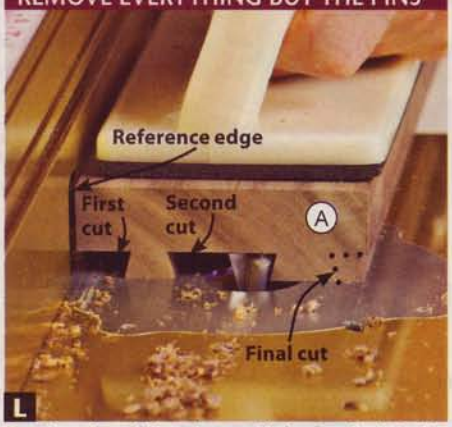
**2** With a ¼" Forstner bit, drill mating holes in the top (A) and bottom (B) to accept the magnet and steel locking

CENTER THE BIT IN TWO PASSES

K

Rotating the stock and making two passes helps center the bit on the stock, but remember to position the marked reference edge against the fence for all other cuts.

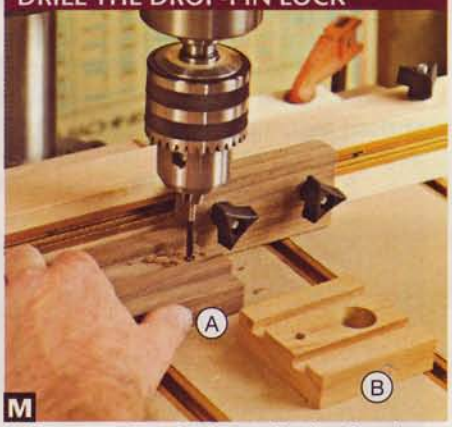
REMOVE EVERYTHING BUT THE PINS




L

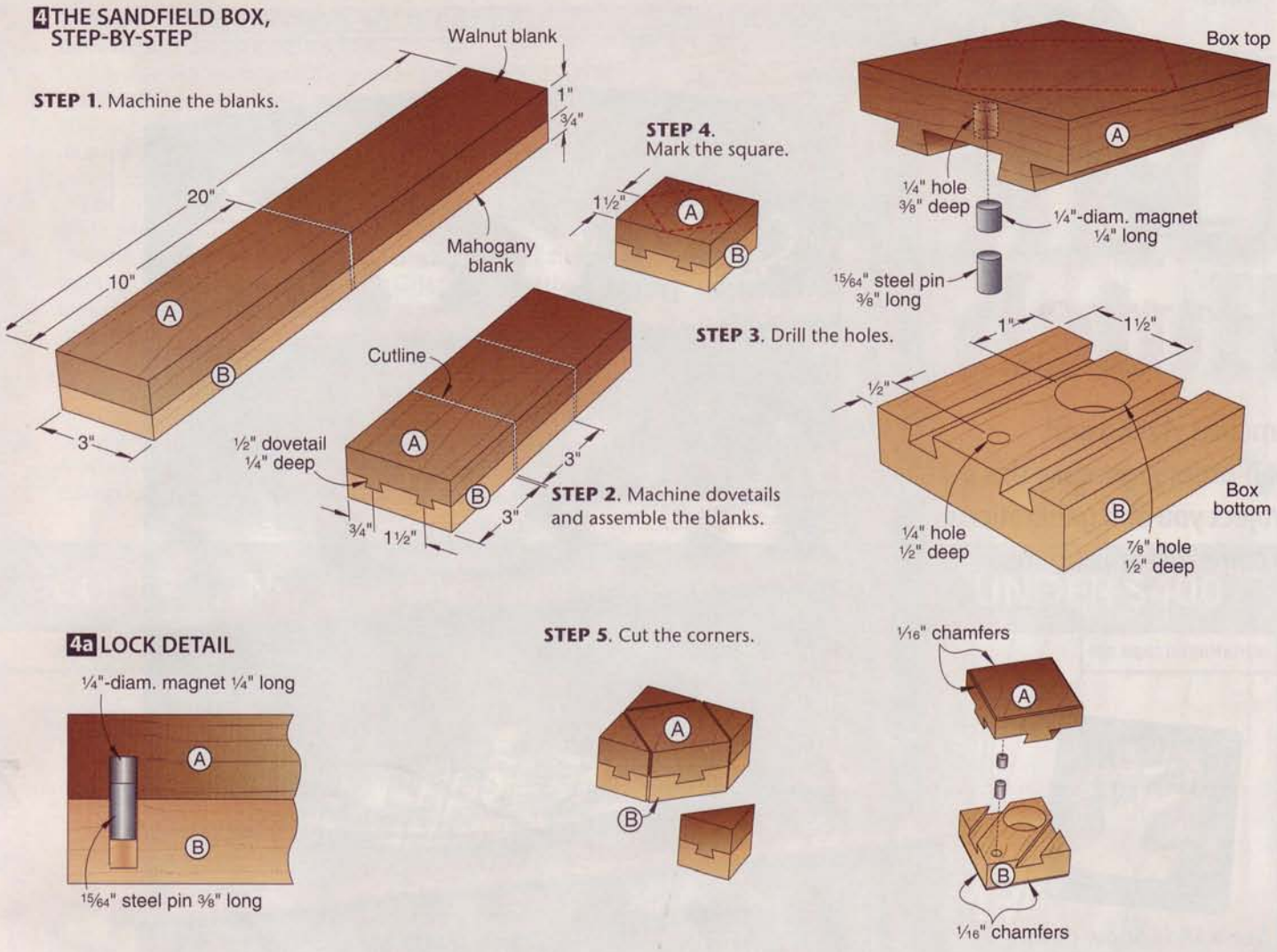
Cutting the sliding dovetail pins in the blank for the top (A) is a three-step operation. Use the fence as a guide, and take light cuts to reduce tear-out in the workpiece.

DRILL THE DROP-PIN LOCK




M

Without moving the fence after boring the ⅞" hole in the bottom (B), reposition the stopblock, and drill the ¼" holes in the top (A) and bottom (B).




pin, where dimensioned [**Photo M, Drawing 4a**]. Rest the reference edge against the fence so the pinholes line up.

**3** Apply CA glue into the hole in the top (A), and then press the magnet into place [**Photo N**].

## Finish the box

**1** Using a combination square, draw 45° lines connecting the center points of each side of your box. Then bandsaw just shy of your lines as shown in [**Photo O**].

**2** Sand up to your pencil lines with a belt sander as shown in [**Photo I**], and finish-sand the box.

**3** Using 220-grit paper, lightly chamfer any sharp corners; then spray on two light coats of shellac.

INSERT THE MAGNET

**N**

**Give the quick-setting glue several minutes to dry. If the magnet shifts, the box might become permanently locked.**

BANDSAW OUT THE BOX

**O**

**Small parts can be cut safely on the bandsaw. Install the locking pin before cutting so the top and bottom can't shift.**


Written by **Joe Hurst-Wajazcuk**
Photos: **Marcus Irvin**
Illustrations: **Roxanne LeMoine; Lorna Johnson**


## Sources

**Caged Dove**

**8mm rare-earth magnet:** #127198, 10 for $11; Call Woodcraft Supply at 800-225-1153 or visit woodcraft.com.

Bits: ½" 14° dovetail router bit, 1" and 5⁄16" Forstner bits.

**Sandfield Box**

**Magnet and steel locking pin set:** item #PUZ-1, $1 per pair, (add $2.95 for shipping); Call 888-636-4478 or online at woodmagazine.com/puzzlepin.

**Fence:** Incra Universal Precision Positioning Jig, #25971, $60. Call Rockler at 800-279-4441 or visit rockler.com.

Bits: ½" 14° dovetail router bit, ¼" and ⅞" Forstner bit.

# Classic Country Oak Hutch

**Timeless styling and mail-order legs make this a project you and generations to come will appreciate.**

See a Slide Show of this project coming together at woodmagazine.com/slides.

This piece matches the drop-leaf table (at *left*) featured in the December/January 2007/2008 issue.

## PROJECT HIGHLIGHTS

- Overall dimensions: 51⅞" wide × 19" deep × 79⅛" high.
- To save time and money and guarantee perfect results, purchase the crown molding from a lumberyard or home center, and mail-order the legs. (See **Sources**.)
- If you wish to turn the legs, see the *WOOD Patterns®* insert in the center of the magazine for a full-size pattern.

### Skill Builder

- Learn how the right hinges and a simple marking method make hanging inset doors a snap.

# Buffet

## Make the end assemblies

**1** Cut the end rails (A) to size [**Materials List**, *page 44*]. Rout a ¼" bead along the outside bottom edge of each center end rail [**Drawing 1a**]. Then cut a groove the thickness of ¾" plywood in the inside face of each lower end rail [**Drawing 1**]. Now cut slots for #10 biscuits in the end of each rail. Finish-sand the rails.

**2** Cut the end panels (B) to size. Then cut a rabbet along the top and bottom edge of each panel [**Drawing 1**]. Finish-sand the panels.

**3** Glue and clamp the top and center end rails (A) into the end panel (B) rabbets [**Drawing 1**]. Keep the rail ends and the panel edges flush.

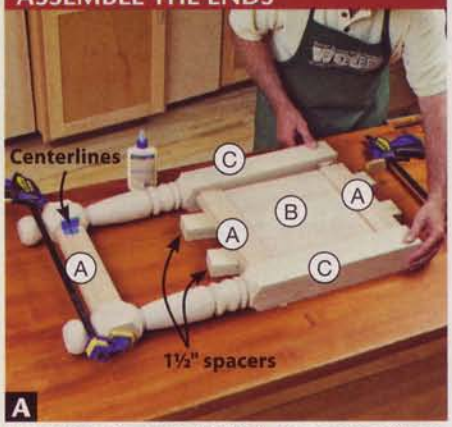
**4** Lay out the biscuit slot locations on the top post and stretcher post of each leg (C) [**Drawing 1**]. (See **Sources** for the legs.) Then cut slots for #10 biscuits. Inspect the legs, and finish-sand them where needed.

**5** Apply masking tape to the lower end rails (A) and the leg (C) stretcher posts, and mark centerlines. Then glue, biscuit, and clamp the end assemblies [**Photo A**].

## Build the case

**1** Cut the divider panels (D) and divider banding (E) to width and 1" longer than listed. Then glue and clamp

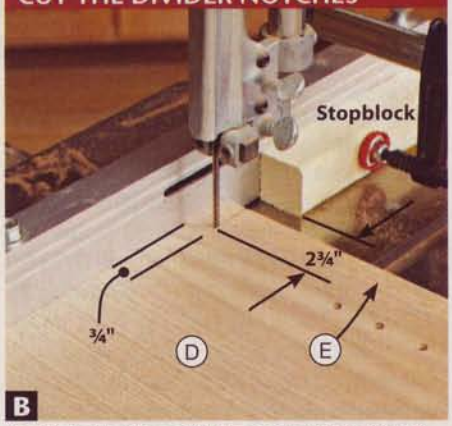
### ASSEMBLE THE ENDS




A

Assemble the ends (A/B/C). Align centerlines marked on masking tape, and keep the top rail (A) flush with the tops of the legs (C).

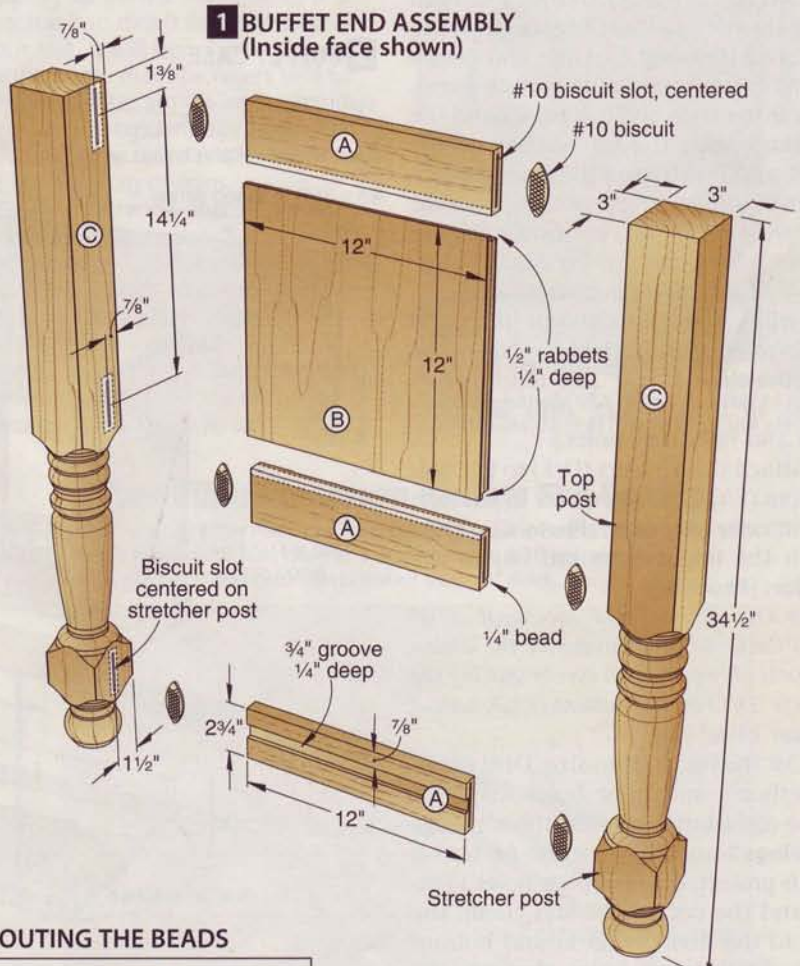
### CUT THE DIVIDER NOTCHES



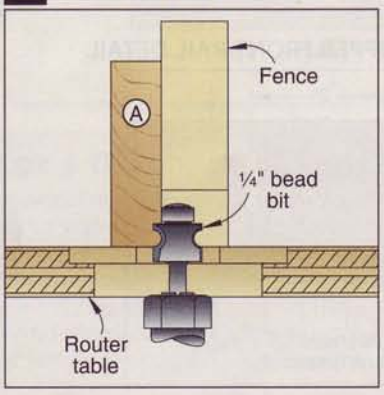

B

Position the fence ¾" from the right side of the blade, clamp a stopblock 2¾" from the front of the blade, and make the first cut.

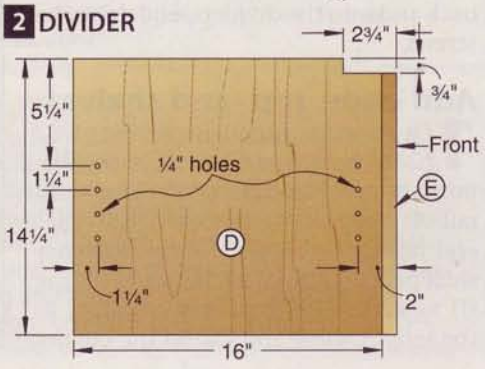
### 1 BUFFET END ASSEMBLY (Inside face shown)




### 1a ROUTING THE BEADS




### 2 DIVIDER



the banding to the front edge of the panels. With the glue dry, sand the banding flush with the panel faces. Now cut the dividers to length, trimming both ends.

**2** Lay out shelf-support hole centers on the dividers (D/E) [**Drawing 2**]. Drill the holes with a ¼" brad-point bit.

**3** Cut notches in the dividers (D/E) for the upper front rail (G) [**Drawing 2**]. Make the 2¾"-long cuts on your bandsaw using the fence and a stopblock [**Photo B**]. Then finish the notches by repositioning the fence and stopblock and making the ¾"-long cuts. Finish-sand the dividers.

**4** Cut the bottom panel (F) and front rails (G) to size. Then rout a ¼" bead along the bottom front edge of the lower front rail [**Drawing 3**]. Glue and clamp the lower front rail to the bottom panel, flush at the ends and top edge. Sand the rail flush with the top surface of the panel, and finish-sand the assembly.

***Note:*** *To ensure a tight joint between the lower front rail (G) and the divider banding (E), use a hard, flat sanding block to sand the rail flush with the bottom panel (F).*

**5** Drill countersunk shank holes and form 3⁄16" slots in the upper front rail (G) [**Drawings 3** and **3a**]. (For the #8 screws in this project, drill 7⁄64" pilot holes and 5⁄32" shank holes.)

**6** Attach the dividers (D/E) to the bottom (F/G), using a spacer to position the interior dividers [**Photo C**]. Then attach the upper front rail (G) to the dividers [**Photo D**].

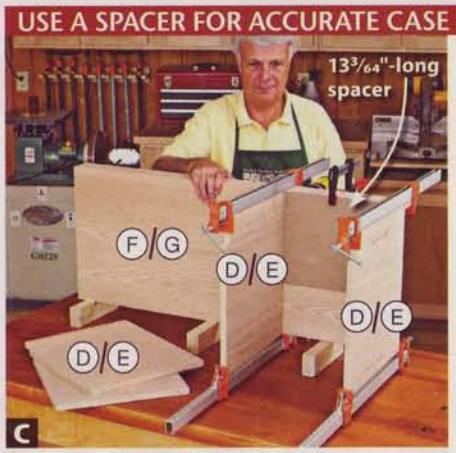
***Note:*** *Our ¾" plywood measured .703" (45⁄64") thick. To compensate for the under-thickness plywood when evenly spacing the dividers (D/E) on the bottom (F/G), we cut a spacer 13 3⁄64" long.*

**7** Cut the back (H) to size. Drill counterbores and pilot holes for three figure-eight fasteners into the top edge [**Drawings 3** and **3b**]. (For the #6 screws in this project, drill 3⁄32" pilot holes.) Finish-sand the back. Glue and clamp the back to the dividers (D/E) and bottom (F/G). Drill screw holes through the back and into the dividers, and drive the screws.

## Add ends, top, and shelves

**1** Dry-clamp the end assemblies (A/B/C) to the case, and measure the distance from the bottom of one lower end rail (A) groove to the bottom of the other end rail groove. Then cut the stretcher shelf panel (I) and stretcher shelf edging (J) to size, using your measurement as the length. Glue and clamp the edging

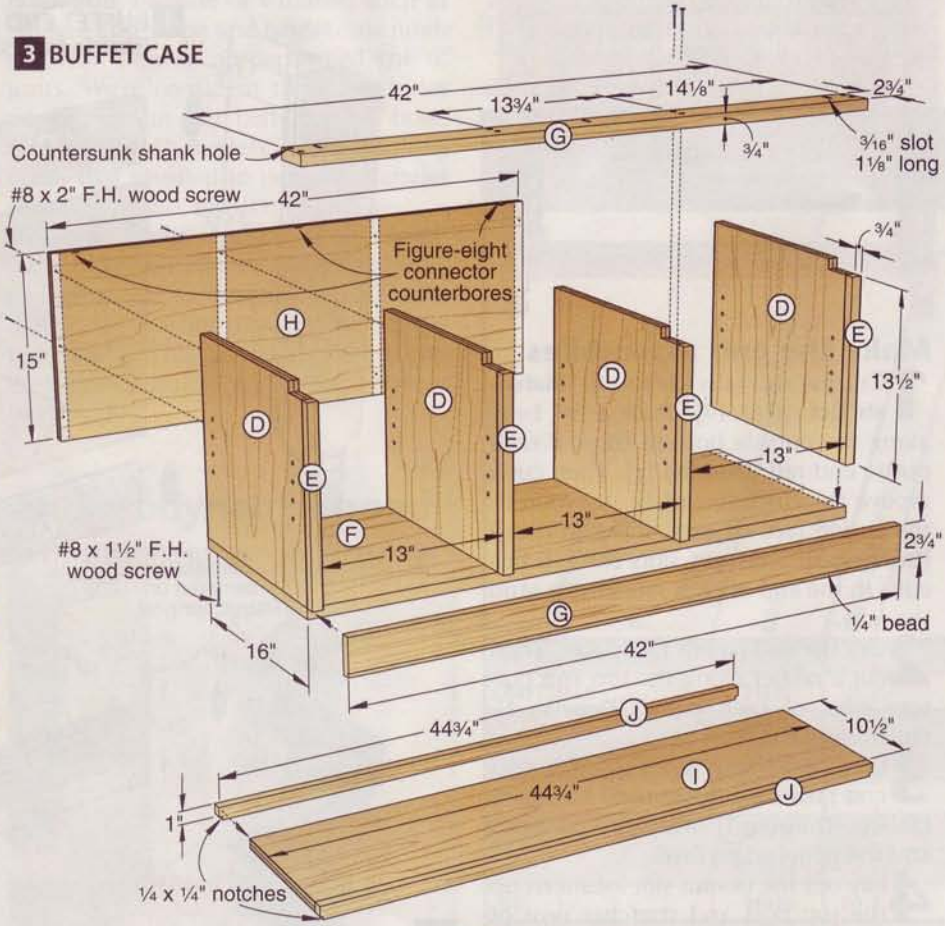
**USE A SPACER FOR ACCURATE CASE ASSEMBLY**



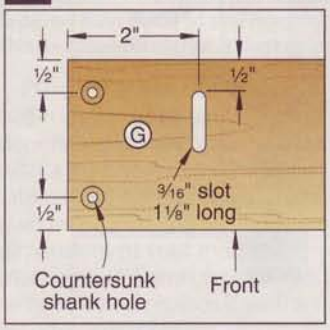

Glue and clamp the dividers (D/E) to the bottom (F/G), using a spacer to position them. Drill screw holes through the bottom and into the dividers, and drive the screws.

Glue and clamp the upper front rail (G) into the divider (D/E) notches. Using the holes in the rail as guides, drill pilot holes into the dividers, and drive the screws.

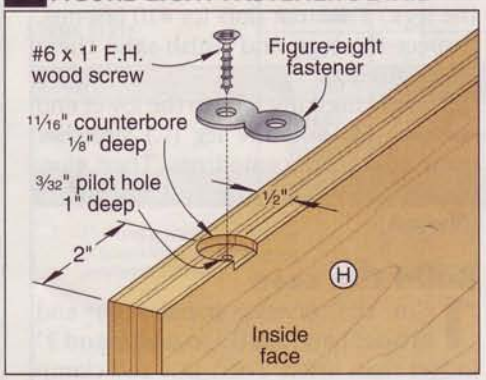
**3 BUFFET CASE**




**3a UPPER FRONT RAIL DETAIL**




**3b FIGURE-EIGHT FASTENER DETAIL**



to the panel, flush at the top. Cut notches in the ends of the edging [**Drawing 3**]. Finish-sand the shelf.

**2** Glue and clamp one end assembly (A/B/C) to the case, flush at the top and back. Then, with the glue dry, add the other end assembly and the stretcher shelf (I/J) [**Photo E**].

**3** Cut the shelf panels (K) and shelf banding (L) to width and 1" longer than listed. Then glue and clamp the banding to the panels. With the glue dry, sand the banding flush with the panel faces. Now cut the shelves to length, trimming both ends.

**4** Edge-glue an oversize blank for the top (M). Sand the blank smooth and trim it to finished size. Then chuck a ⅜" round-over bit into a handheld router [**Drawing 4a**], and rout the ends, and then front edge [**Drawing 4**].

## Now make the doors

**1** Cut the stiles (N), rails (O), and panels (P) to size. Then make the doors [**Drawings 5** and **5a**], as shown starting on *page 46*. Now, with the doors complete, drill knob screw holes, mount the hinges on the doors, and hang the doors in the case openings. For guaranteed door-hanging success, see *page 88*.

**2** Mount the spring catches on the bottom face of the upper front rail (G), and the strikes on the door stiles (N) [**Drawings 4** and **5**].

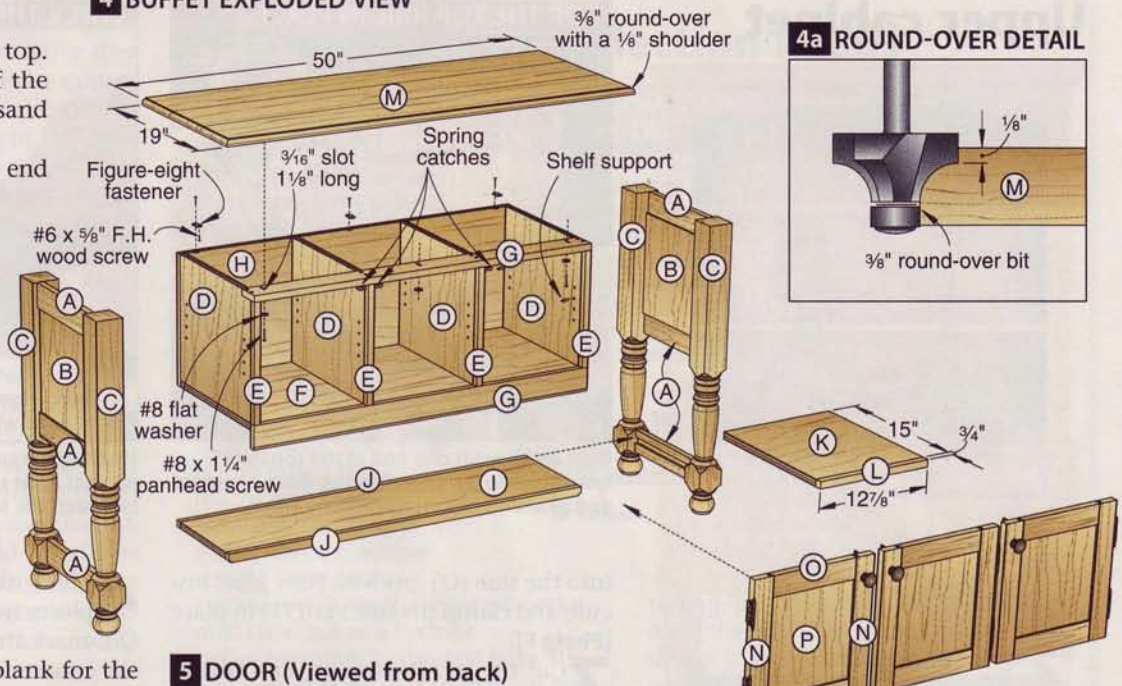
## Finish and assemble

**1** Remove the hinges and spring catches. Inspect all the parts, and finish-sand where needed. Apply the finish. (We stained with Varathane Golden Oak no. 227, and let it dry for 24 hours. Then we sprayed on two coats of Minwax Satin Polycrylic, sanding between coats with 220-grit sandpaper.)

**2** Install figure-eight fasteners on the back (H) [**Drawings 3b** and **4**]. Clamp the top (M) to the case, flush at the back and centered side-to-side. Using the holes in the figure-eight fasteners and the centers of the slots in the upper front rail (G) as guides, drill pilot holes into the top. Fasten the top with screws and flat washers [**Drawing 4**].

**3** Rehang the doors and install the catches and knobs. Install the shelf supports and shelves.

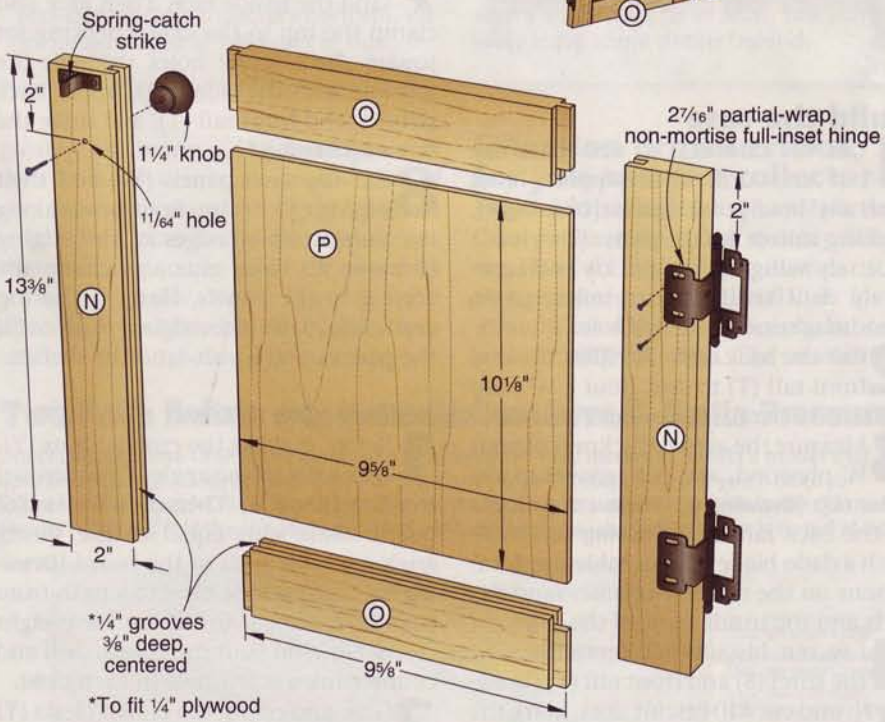
**4 BUFFET EXPLODED VIEW**



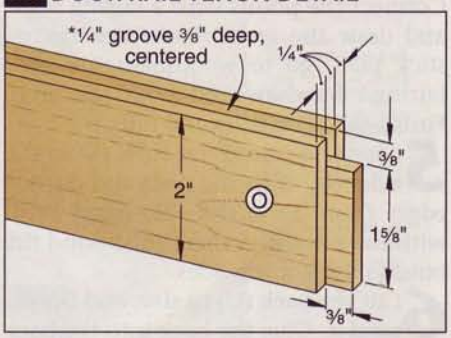

**4a ROUND-OVER DETAIL**




**5 DOOR (Viewed from back)**




**5a DOOR RAIL TENON DETAIL**

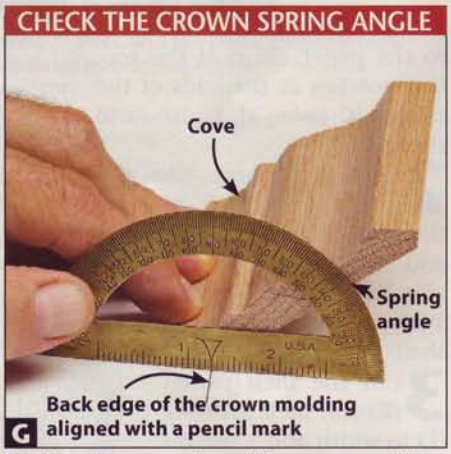



**ADD THE ENDS AND SHELF**

**Capturing the stretcher shelf (I/J) within the lower end rail (A) grooves, glue and clamp the second end assembly in place.**

# Upper cabinet

Glue and biscuit one end of the top rail (T) into one stile (S). Then flex the sides (Q) apart and glue and biscuit the other end.




Holding the cove edge of the crown molding against a flat surface, measure the angle between the surface and the molding back.

## Build the case

**1** Cut the sides (Q) to size. Then lay out and drill shelf-support holes with a ¼" brad-point drill bit [**Drawing 6**], making mirror image parts. (To view a video showing how to quickly and accurately drill shelf-support holes, go to woodmagazine.com/shelfholes.)

**2** Cut the back rails (R), stiles (S), and front rail (T) to size. Rout a ¼" bead into the back rails [**Drawings 7** and **7a**].

**3** Measure the actual thickness of your ¼" plywood, and cut grooves in the sides (Q) [**Drawing 6**]. Then cut grooves in the back rails (R) [**Drawing 7a**]. Now, with a dado blade in your tablesaw, form tenons on the rail ends. Finish-sand the rails and the inside faces of the sides.

**4** Lay out biscuit slot centerlines on the stiles (S) and front rail (T) [**Drawing 7**], and cut #10 biscuit slots. Mark the ends and center of the front rail arch. Connect the points with a fairing stick, and draw the arch. (For a free fairing stick plan, go to woodmagazine.com/fairing.) Bandsaw and sand the arch. Finish-sand the stiles and rail.

**5** Glue and clamp the stiles (S) to the sides (Q) with the ends and outside edges flush. Sand the stile edges flush with the sides, and then finish-sand the outside faces of the sides.

**6** Cut the back (U) to size, and finish-sand it. Glue the back into the back rail (R) grooves, with the edges of the back and the rail tenon ends flush. Then glue and clamp the rail tenons and back into the side (Q) grooves. Now glue, biscuit, and clamp the front rail (T) in place [**Photo F**].

**7** Cut the top (V) to size, and finish-sand the inside face. Then glue and clamp the top to the case, checking for square. Drill screw holes through the top and into the sides (Q), upper back rail (R), and front rail (T), and drive the screws [**Drawing 7**].

**8** Cut the shelf panels (W) and shelf edging (X) to size. Rout beads along the outside lower edges of the edging [**Drawing 7**]. Then glue and clamp the edging to the panels, flush at the top and ends. Sand the edging flush with the panels, and finish-sand the shelves.

## Install the crown

**1** Before making the crown cleats (Y), check the spring angle of your crown molding [**Photo G**]. Then cut a ¾×1½×36" board. Make cuts equal to the spring angle on both ends of the board [**Drawing 7b**], and cut one cleat to length from each end. Repeat until you have eight cleats. Now, on your drill press, drill and countersink a screw hole in each cleat.

**2** Glue and clamp the crown cleats (Y) to the top (V) [**Drawings 7** and **7b**], and screw them in place [**Photo H**].

**3** Mark the center of an 8' length of crown molding. (We used standard ⅝×3¼" crown available at lumberyards and home centers.) Measure the width of the case, and working from the center of the length of crown molding to each end, mark this dimension. (This is the miter-heel-to-miter-heel length.) Then cut the crown front (Z) to length by cutting a compound miter at each end. (To view a video showing how to miter crown molding, go to woodmagazine.com/crownmldg.) Glue and clamp the crown front to the case [**Photo I**].

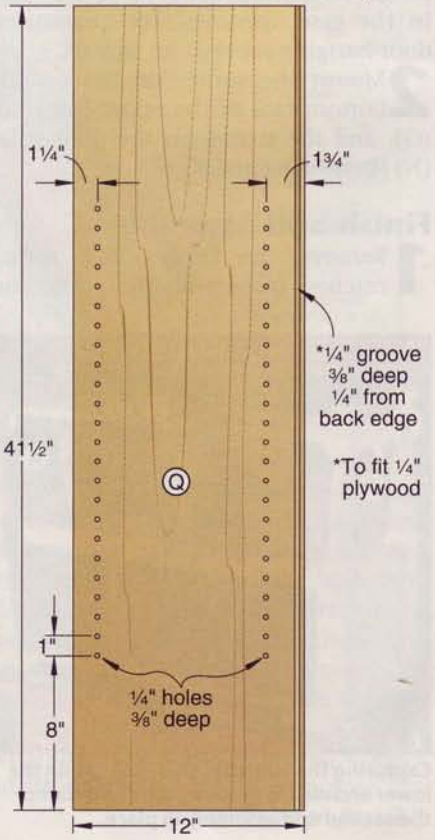
**4** Miter the two remaining crown pieces to mate with the crown front (Z), mark the length [**Photo J**], and cut the crown sides (AA) to length. Glue and clamp the crown sides in place. Finish-sand the crown.

## Finish and assemble

**1** Inspect all the parts and assemblies, and finish-sand where needed. Apply stain and a clear finish.

**2** Drill pilot holes and screw mending plates to the buffet back (H) [**Drawing 7**]. Then position the upper cabinet

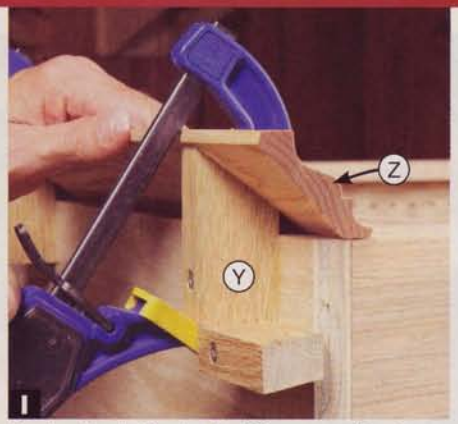
**6** UPPER CASE SIDE
(Inside face of left side shown)



## INSTALL THE CROWN MOLDING

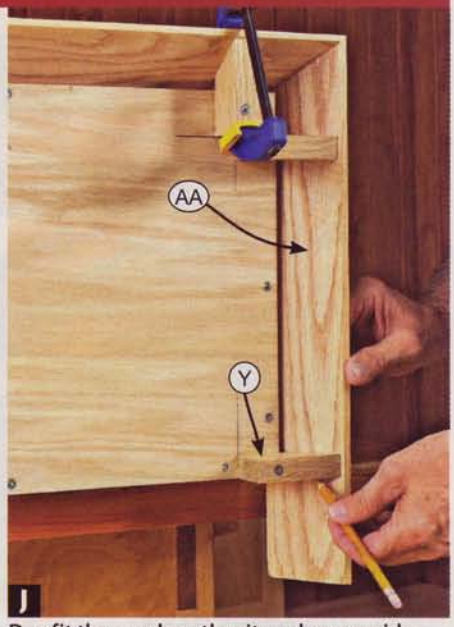
H

Aligning the square end of each crown cleat (Y) with a layout line, glue and clamp, and then screw them in place.




I

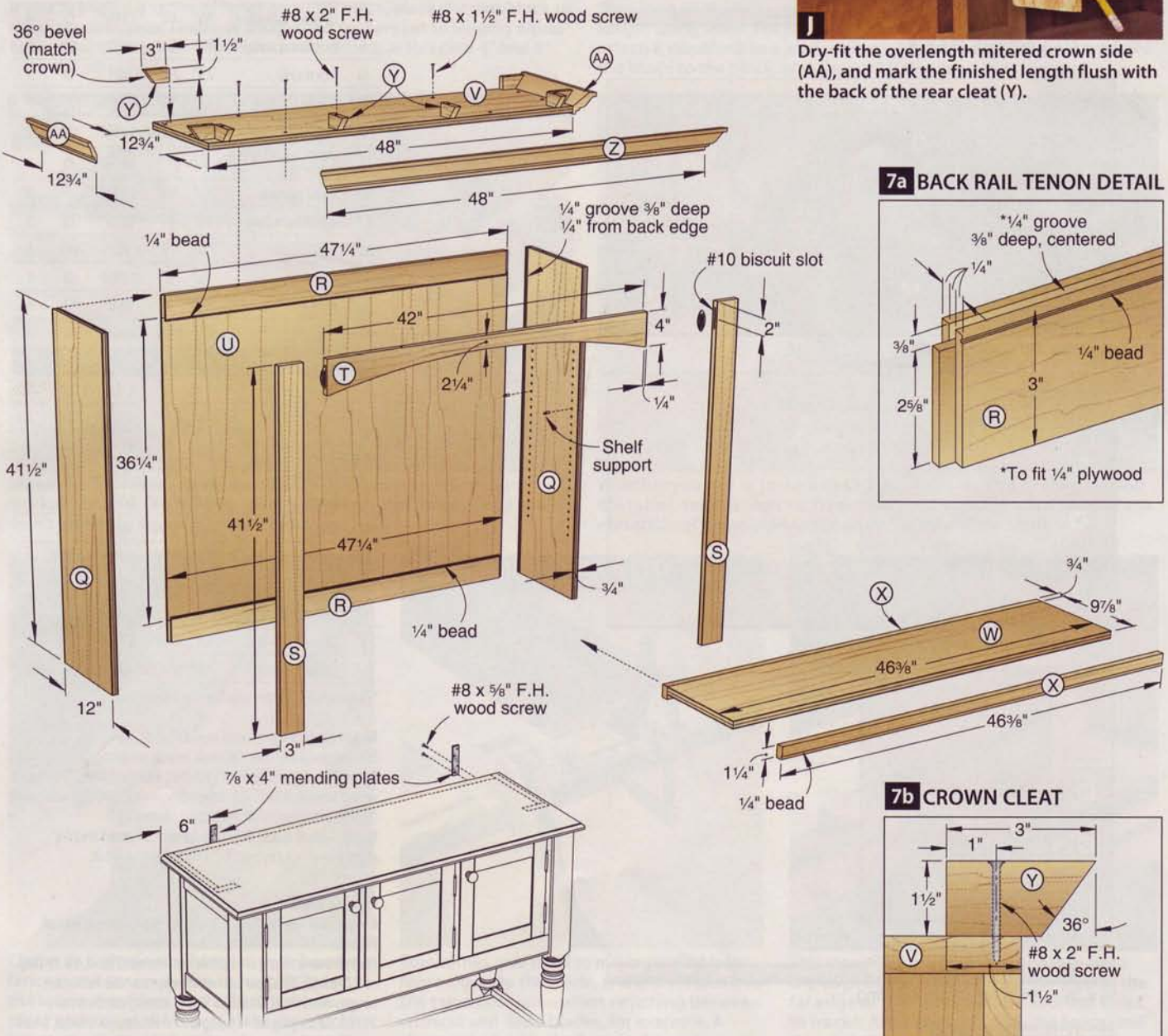
Apply glue to the back of the crown front (Z) along the bottom edge and to the crown cleats (Y), and clamp the crown in place.




J

Dry-fit the overlength mitered crown side (AA), and mark the finished length flush with the back of the rear cleat (Y).

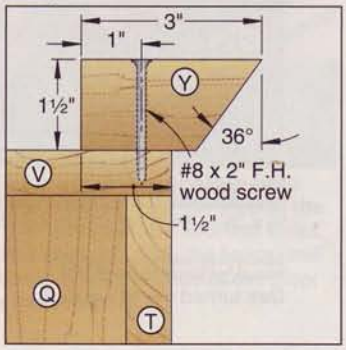
## 7 UPPER CABINET EXPLODED VIEW



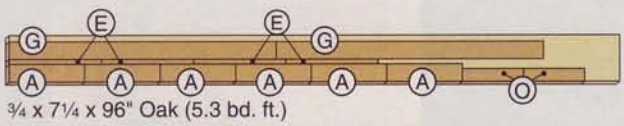

## 7a BACK RAIL TENON DETAIL



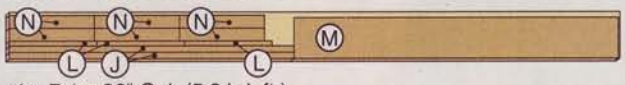

## 7b CROWN CLEAT



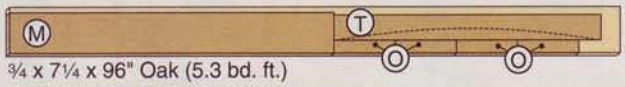
## Cutting Diagram



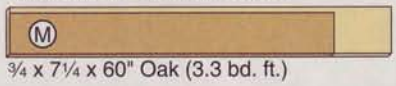
¾ x 7¼ x 96" Oak (5.3 bd. ft.)



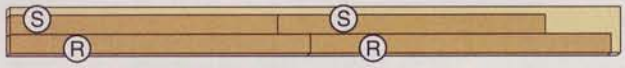
¾ x 7¼ x 96" Oak (5.3 bd. ft.)



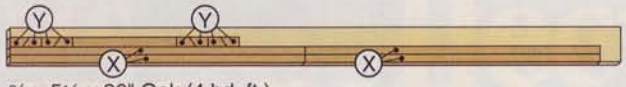
¾ x 7¼ x 96" Oak (5.3 bd. ft.)



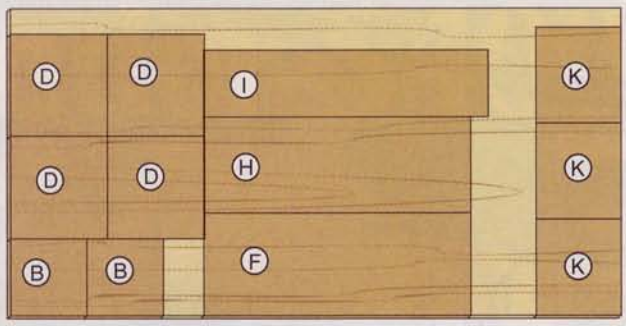
¾ x 7¼ x 60" Oak (3.3 bd. ft.)



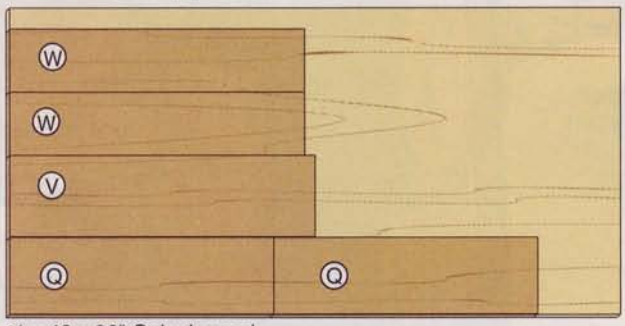
¾ x 7¼ x 96" Oak (5.3 bd. ft.)



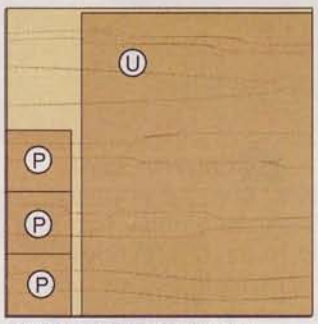
¾ x 5½ x 96" Oak (4 bd. ft.)



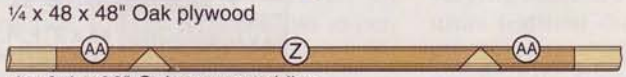
¾ x 48 x 96" Oak plywood



¾ x 48 x 96" Oak plywood



¼ x 48 x 48" Oak plywood



⅝ x 3¼ x 96" Oak crown molding

Oak turned leg (4 needed)

on the buffet, flush at the back and centered side-to-side. Now using the holes in the mending plates as guides, drill pilot holes into the lower back rail (R) and drive the screws.

**3** Insert shelf supports into the upper cabinet side (Q) holes, and install the shelves (W/X).


Written by **Jan Svec** with **Chuck Hedlund**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine; Lorna Johnson**


## Materials List

| | | FINISHED SIZE T | W | L | Matl. | Qty. |
|---|---|---|---|---|---|---|
| **Buffet** | | | | | | |
| A | end rails | ¾" | 2¾" | 12" | O | 6 |
| B | end panels | ¾" | 12" | 12" | OP | 2 |
| C | legs | 3" | 3" | 34½" | O | 4 |
| D* | divider panels | ¾" | 16" | 14¼" | OP | 4 |
| E* | divider banding | ¾" | ¾" | 13½" | O | 4 |
| F | bottom panel | ¾" | 16" | 42" | OP | 1 |
| G | front rails | ¾" | 2¾" | 42" | O | 2 |
| H | back | ¾" | 15" | 42" | OP | 1 |
| I | stretcher shelf panel | ¾" | 10½" | 44¾" | OP | 1 |
| J | stretcher shelf edging | ¾" | 1" | 44¾" | O | 2 |
| K* | shelf panels | ¾" | 15" | 12⅞" | OP | 3 |
| L* | shelf banding | ¾" | ¾" | 12⅞" | O | 3 |
| M* | top | ¾" | 19" | 50" | EO | 1 |
| N | stiles | ¾" | 2" | 13⅜" | O | 6 |
| O | rails | ¾" | 2" | 9⅝" | O | 6 |
| P | panels | ¼" | 9⅝" | 10⅛" | OP | 3 |
| **Upper cabinet** | | | | | | |
| Q | sides | ¾" | 12" | 41½" | OP | 2 |
| R | back rails | ¾" | 3" | 47¼" | O | 2 |
| S | stiles | ¾" | 3" | 41½" | O | 2 |
| T | front rail | ¾" | 4" | 42" | O | 1 |
| U | back | ¼" | 47¼" | 36¼" | OP | 1 |
| V | top | ¾" | 12¾" | 48" | OP | 1 |
| W | shelf panels | ¾" | 9⅞" | 46⅜" | OP | 2 |
| X | shelf edging | ¾" | 1¼" | 46⅜" | O | 4 |
| Y* | crown cleats | ¾" | 1½" | 3" | O | 8 |
| Z | crown front | ⅝" | 3¼" | 51⅞" | OC | 1 |
| AA | crown sides | ⅝" | 3¼" | 14¹¹⁄₁₆" | OC | 2 |

*Parts initially cut oversize. See the instructions.

**Materials key:** O–red oak, OP–oak plywood, EO–edge-glued oak, OC–oak crown molding.
**Supplies:** #6×⅝", #6×1", #8×⅝", #8×1½", #8×2" flathead wood screws; #8×1¼" panhead screws (3); #8 flat washers (3); #10 biscuits; ⅞×4" mending plates (2).
**Blade and bits:** Stack dado set, ¼" bead and ⅜" round-over router bits, ¼" brad-point drill bit.

## Sources

**Legs:** Oak leg no. 1487, $31.50 ea. (4). Osborne Wood Products, 800-849-8876, osbornewood.com.
**Hardware:** Figure-eight fasteners no. 21650, $2.39 pkg. of 8 (1 pkg.); 2⁷⁄₁₆" partial-wrap non-mortise full-inset hinges no. 31495, $6.99 pr. (3 pr.); spring catches no. 29785, $3.59 pkg. of 4 (1 pkg.); 1¼" knobs no. 26588, $4.29 ea. (3); shelf supports no. 22781, $2.99 pkg. of 16 (2 pkgs.). Rockler, 800-279-4441, rockler.com.

# Simple Frame-and-Panel Doors in 30 minutes

In the time it takes to sit through a sitcom on TV, you can have some real fun creating these sturdy, no-fuss doors.

Frame-and-panel doors add class to any project, but they don't have to add a lot of assembly time. Using the straightforward process detailed here, you can crank out great-looking doors for many applications, including furniture, cabinets, and built-ins. Frames use ¾"-thick stock with ¼" panels in various materials and veneers. (See *page 49.*) A general-purpose saw blade will do the job, although a dado stack cuts smoother tenons.

Take a few minutes to tune your tablesaw before cutting any project parts. Check that the fence and miter slots run parallel to the blade. Attach an extension to the miter gauge, and use a drafting triangle to square the gauge to the blade. Then lock your blade at precisely 90° to the tabletop. Okay, let's start the stopwatch.

**Step 1:** Calculate your door dimensions using the plan *below*. From ¾" stock, rip all rail-and-stile stock to width Ⓒ (2" wide in the example *above*). Cut extra stock just in case you make a mistake.

**Success secrets:** For uniform color and grain match between the frame parts, cut them from the same board. The technique we'll use later to cut grooves and tenons requires stock exactly ¾" thick, so thickness plane all frame stock at one time. Then take advantage of these doors' easy assembly, and complete the remaining steps before the wood has time to move.

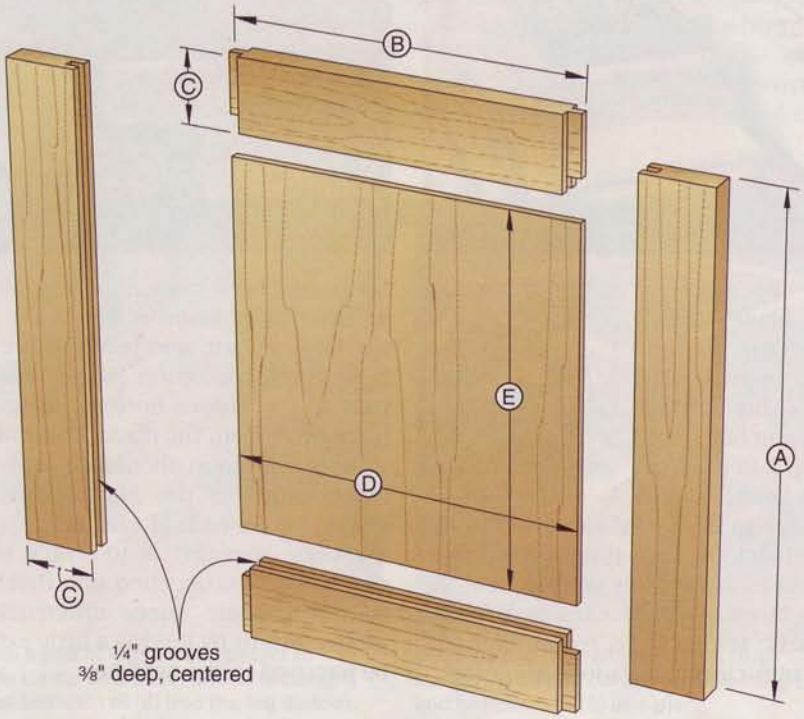
**Step 2:** Attach a spacer block near the front of the fence with double-faced tape, and lock the fence where the distance between the block and blade equals the stile length Ⓐ. Cut the stiles, re-adjust the fence, and cut the rails Ⓑ.

**Success secrets:** Because the workpiece slides free of the fence-mounted spacer block before you cut, there's little danger of kickback. Cut your longest frame parts (usually the stiles) first. Why? If you make a measurement mistake, you can reuse the miscut piece for the shorter rails.

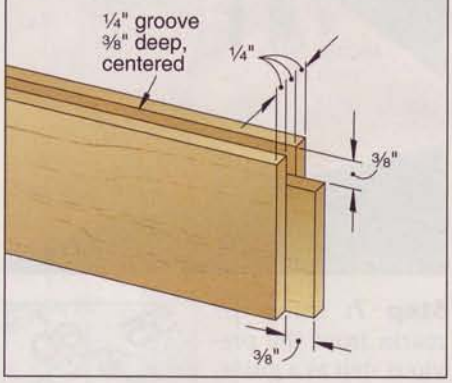
**Step 3:** Adjust the blade height to ⅜" and set the fence to center the blade on the edge of a frame scrap. Make a test cut and measure the depth. If your blade has alternating-bevel teeth that leave an uneven groove bottom, sand it flat as shown on *page 49*.

**Success secrets:** Grooves, as illustrated *below*, can be cut in fewer passes with a regular blade instead of a thin-kerf blade. Once you perfect the depth, lock the blade height to ensure uniform cuts on each piece. Reduce tear-out by using a zero-clearance tablesaw insert.

## HOW TO DETERMINE FRAME-AND-PANEL DOOR DIMENSIONS




## TENON AND GROOVE DETAIL




**To size an inset door for a specific opening, first subtract ⅛" from the size of the opening to allow a 1/16" reveal around the door. Then figure the part sizes as follows:**

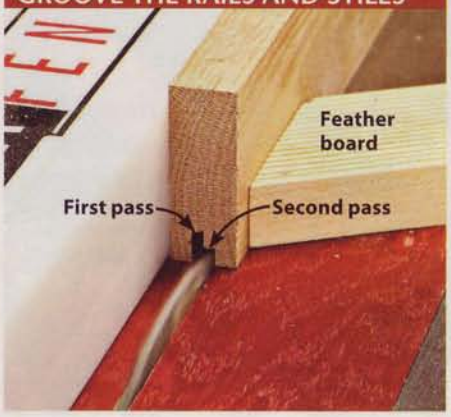
- **The length of the stiles Ⓐ equals the door height.**
- **The rail length Ⓑ equals the door width minus two times the stile width Ⓒ plus ¾" for the two ⅜" tenons.**
- **The panel width Ⓓ equals the length of Ⓑ minus 1/16".**
- **The panel length Ⓔ equals just less than the stile length Ⓐ minus two times the rail width Ⓒ plus ¾".**

## TEST-CUT FOR GROOVE WIDTH

**Step 4:** Move the fence away from the blade about 1/16". Cut one groove in scrap, then turn it end-for-end for a second pass. Measure the width of the groove, and gradually move the fence away from the blade until the two cuts produce a 1/4"-wide groove. (Every fence movement doubles the width of the groove.)

**Success secrets:** Measure your panel thickness before cutting grooves into the frame. Actual panel stock thickness may vary slightly from 1/4", especially if you try some of the decorative panels shown on *page 49*. You can increase or decrease the groove width up to 1/16" to accommodate your panel thickness.

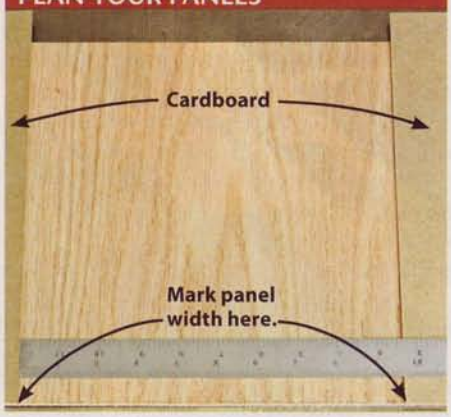
## GROOVE THE RAILS AND STILES




**Step 5:** Cut a kerf on one edge of a stile or rail. Rotate the part end-for-end and make the second pass to complete the groove, as in Step 4. Repeat both cuts for the remaining rails and stiles.

**Success secrets:** For consistency, use a feather board as shown *above*. Feed stock over the blade as quickly as possible to avoid burning the inside of the groove, which can reduce the strength of the glue joint. (Scorched surfaces do not absorb glue well.)

## PLAN YOUR PANELS




**Step 6:** For maximum visual impact, center prominent grain shapes, such as cathedral pattern. To visualize the final look, mask out the width of the panel using two strips of cardboard spaced apart the same width as the panel. If necessary, add two more pieces of cardboard to mark the top and bottom of the panel. Then mark the area to be cut.

**Success secrets:** If your plywood has a glue line on its face, avoid it on the panel or center it as a pattern element.

## CUT PANELS TO SIZE

**Step 7:** Using the marks from the previous step as a guide, cut the panel to size.

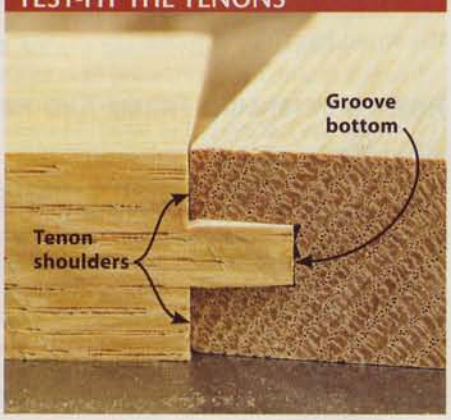
**Success secrets:** To prevent tear-out, use a zero-clearance throat insert. If cross-cutting tear-out extends more than 3/8" in from the ends of the panel, replace or resharpen your saw blade.

## CUT TEST TENONS IN SCRAP

**Step 8:** Install a dado blade slightly wider than 3/8", and raise it to just greater than 1/4" high. Attach the spacer block used in Step 2 to the front of the fence; then set the fence to leave a 3/8" gap between the spacer block and the left side of the blade. Butt the end of a frame scrap against the spacer block before dadoing each face.

**Success secrets:** To reduce tear-out, use a zero-clearance dado-blade insert.

## TEST-FIT THE TENONS




**Step 9:** Check the tenon fit on a stile groove. If the tenon is too thick, raise the blade height, and recut until it fits. Now check the tenon length. To cure gaps at the groove bottom, nudge the fence away from the blade. To eliminate gaps at the tenon shoulders, move the fence closer to the blade. Then cut tenons on the ends of each rail.

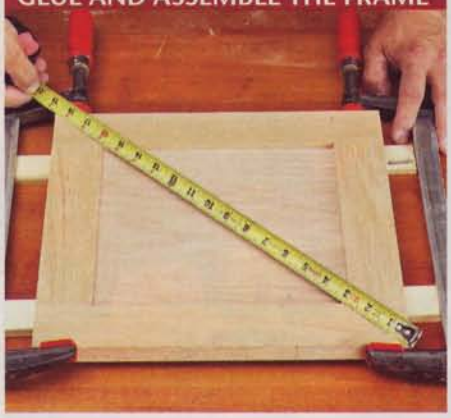
**Success secrets:** A too-thick tenon can be fixed easier than one that's too thin. Anticipate minor differences in groove widths by leaving a little extra to be removed in the next step.

### FINE-TUNE THE TENON THICKNESS

**Step 10:** To thin slightly oversize tenons, make a sanding block by attaching 100-grit, adhesive-backed sandpaper to one face of a hardboard scrap. Sand using the same number of passes on each side of the tenon to keep it centered.

**Success secrets:** This also eliminates minor scoring from the dado blade, producing a stronger glue joint. By applying sandpaper to just one face of the scrap, you avoid marring the tenon shoulders.

### GLUE AND ASSEMBLE THE FRAME



**Step 11:** Dry-fit the joints with the panel to confirm the correct panel size, as shown on *page 46*. Then glue one tenon on each rail, and seat them at the ends of a stile. Insert the panel, glue the other two rail tenons, and add the other stile. Clamp and check for square by measuring diagonally for equal distances between the corners.

**Success secrets:** To keep loose panels from rattling, apply a spot of glue to only the centers of both rail grooves.

### OPTIONAL: SAND GROOVES FLAT

**Optional step:** If the groove bottom is ridged from the blade's teeth, lower the blade height about 1/64". Then attach a strip of adhesive-backed sandpaper to the edge of a 7/32"-thick hardboard scrap, and use it to sand away the ridges. Sand with the same number of strokes in each groove for consistent depth.

To eliminate this step, cut grooves with a flat-tooth ripping blade or high-quality dado set. Both leave fewer ridges or score marks on the groove bottom.

## Use different materials for different looks

**Frame:** red oak. **Panel:** oak-veneer medium-density fiberboard.

**Frame:** mission-oak-stained white oak. **Panel:** woven grass wallpaper on hardboard.

**Frame:** red oak. **Panel:** clear acrylic (13/64" thick). Frosted panels also are available.

**Frame:** white oak. **Panel:** vertical-pattern bamboo sheets.

Just because these doors are quick to make doesn't mean they cramp your creativity. To go beyond the basics, rout a cove, round-over, or ogee profile around the front edges of the assembled door. (Do the rails first to limit tear-out.)

For contrast, mix wood species, such as a walnut panel in a maple frame. Then try one of the combinations shown *above* or one of the following panels:

- Punched tin alone or over hardboard.
- Mirrors or decorative glass.
- Wood-veneered hardboard. For veneering tips, see *WOOD*® magazine issue 179 (October 2007), page 42.
- Hardboard coated with chalkboard paint. (Contact Rust-Oleum at 800-323-3584 or rustoleum.com.)
- Beaded wainscotting strips or sheets, available at many home centers.
- Painted sheet steel (for holding magnets) attached to MDF or hardboard using contact cement.
- Perforated hardboard on a shop cabinet door.

# Dovetail Showdown

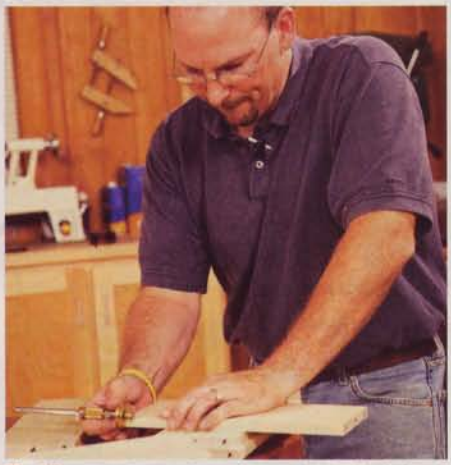
## MAN VS. MACHINE

**Which is faster: Hand- or machine-cut dovetails? Which method yields better results? Armed with their favorite tools, we let two accomplished woodworkers "duel" to find the answers.**

Watch a FREE highlight video of the Dovetail Competition at woodmagazine.com/dtshowdown

### The Challenge

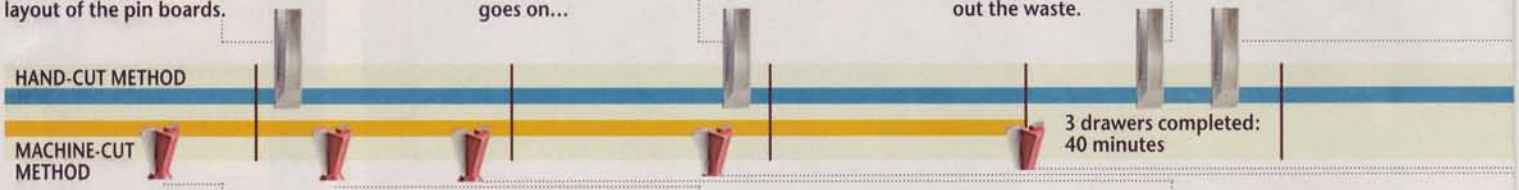
It began with an off-the-cuff comment from Design Editor Jeff Mertz that he could build a drawer box with hand-cut, through-dovetail joints faster than someone using a dovetail jig and router. To test his claim, we pitted him against *WOOD*® magazine tool tester Pat Lowry, who recently had



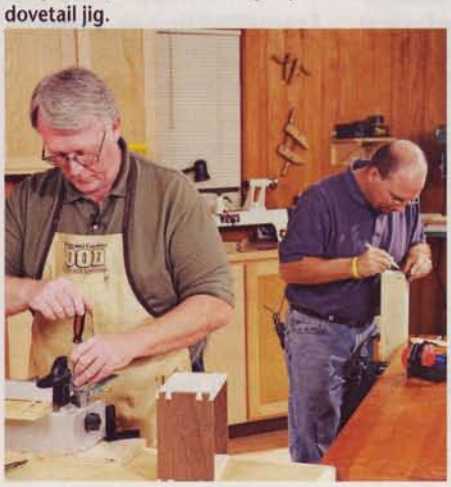
**11:48** With the inside and outside of all of the boards marked, Jeff completes the scribing and layout of the pin boards.

**27:30** Realizing that Pat's already routed his tail boards, Jeff concedes defeat. But the match goes on...

**44:17** After sawing along the marked lines of the pin boards for the first drawer, Jeff finishes chiseling out the waste.

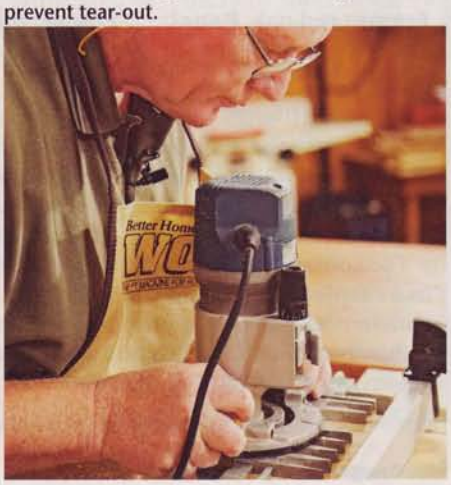



**6:12** After measuring the joint spacing on the sample box, Pat sets the finger positions on the dovetail jig.



**12:32** With the router set, Pat completes the measurements, jig setup, and test cuts. He's ready to cut the tails.

**18:56** Pat machines the tail boards for all three drawers, removing the material slowly to prevent tear-out.



THE SAMPLE BOX JOINERY

**A**
**The contestants had to build their drawer boxes to match this sample.**

tested dovetail jigs for us. The contest: See who could make three drawer boxes with good-quality dovetail joints in the least time while working safely. Why make three boxes and not one? To reveal any efficiencies either method provides when making multiple parts.

Each contestant was given twelve ½×4½×12" poplar boards to make the drawers. They had to replicate the joint in a supplied sample [**Photo A**]. Both contestants were permitted to have all of their tools laid out and ready for use. Pat's tools consisted of a Leigh model D4R dovetail jig that includes bits and guide bushings; a router; and a 4" square, costing $586 total. Jeff's lineup of a fine-tooth Dozuki saw, six-piece chisel set, wheel-type marking gauge, 4" sliding bevel, and wood mallet ran a little less than half the cost of Pat's, or $250. Although Pat selected the top-of-the-line D4R jig for ultimate ease of use and precision, jigs that cost from about $100 to $220 less than this model do a fine job of cutting variably spaced through-dovetails. When using a lower-cost jig, the investment in tools for either method is comparable.

## About the contenders

Besides teaching classes in cabinet construction, Jeff also completed a one-week class in joinery that covered hand-cut dovetails at the Marc Adams School of Woodworking (marcadams.com) in Franklin, Indiana. In the two years since then, Jeff has become proficient at crafting these joints. Pat has experience with many dovetail jigs and is adept at their setup and adjustments.

## The outcome

As shown in the time line, Pat was the winner, completing all three drawers in 40 minutes. Half of his time was used to measure the sample joint, set up the jig and router, and make test cuts. The other half was used to rout the tail and pin boards and assemble the drawers.

Jeff was able to complete just one drawer in 97 minutes. His total time for pin layout for all three drawers, and tail layout for one drawer, was 15 minutes. The remaining time he spent sawing, chiseling, and fine-tuning the joints to assemble the drawer. "I knew that I was in trouble when I heard Pat start to machine all of the pin boards while I was just chiseling away at the first two boards for the first drawer," Jeff notes.

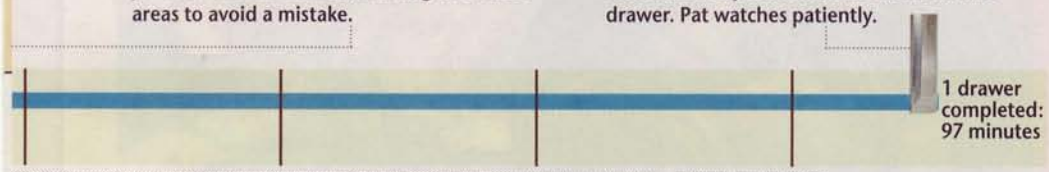
## Post-match analysis

Although the joints produced by both methods look great, it took Jeff about twice as long to hand-cut and fit the joints for one drawer than it did for Pat to machine-cut and assemble all three drawers. Adding a projected time of 85 minutes for each of the remaining drawers, it would have taken Jeff 4½ hours to complete the task.

Pat and Jeff agree that when you have a lot of joints to make, such as for kitchen-cabinet drawers, opt for the timesaving machine-cut process. If you have only one or two drawers to build, go with the hand-cut method unless you're able to quickly set up and adjust your jig and router. (The hand-cut method also creates less fine dust and noise.) For an heirloom project that deserves a handcrafted look, characterized by fine scribe marks for the lengths of the pins and tails, the choice is obvious—reach for your hand tools.

**47:47** Jeff uses the pin boards to lay out the joints on the tail boards, marking the waste areas to avoid a mistake.

**1:36:35** Jeff completes the tail boards and, with minor adjustments, assembles his first drawer. Pat watches patiently.




**27:17** Pat reconfigures the jig and router for cutting the pins. He makes a test cut, and checks the fit with a tail board.

**40:21** With the pin boards routed, Pat assembles the three drawers, verifying his joinery matches the sample box.

Written by **Owen Duvall**
Photographs: **Eric Salmon**

Better Homes and Gardens®

# WOOD® PATTERNS®

*March 2008* *Issue 182*

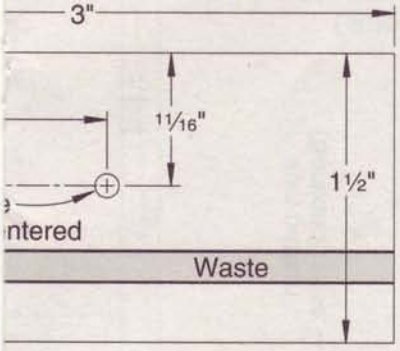
Dear Reader: As a service to you, we've included full-size patterns on this insert for irregular shaped and intricate project parts. You can machine all other project parts using the Materials List and the drawings accompanying the project you're building.

© Copyright Meredith Corporation, 2008. All rights reserved. Printed in the U.S.A. Meredith Corp., the publisher of WOOD Patterns®, allows the purchaser of this pattern insert to photocopy these patterns solely for personal use. Any other reproduction of these patterns is strictly prohibited.

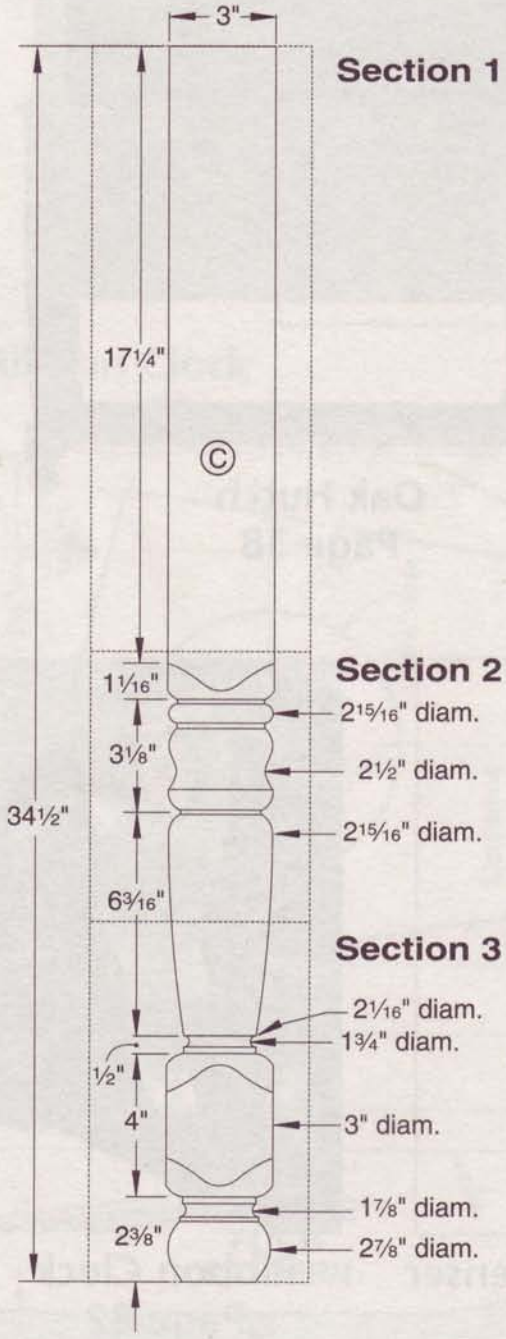
**Oak Hutch**
**Page 38**

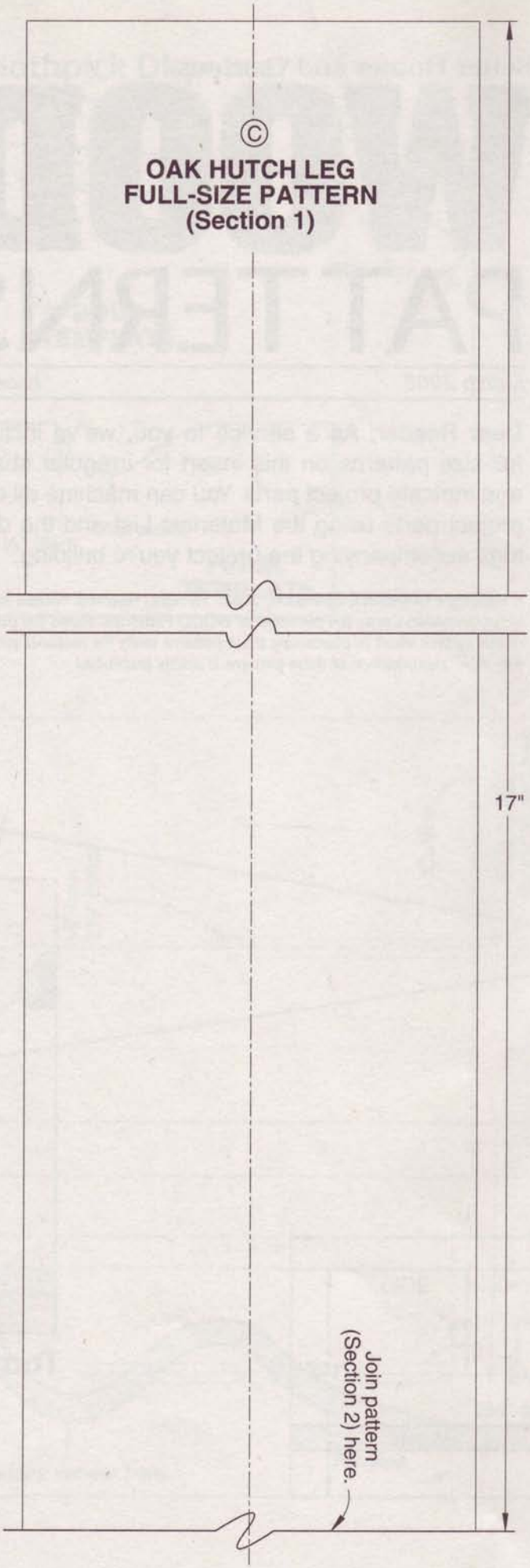
**Toothpick Dispenser**
**Page 72**

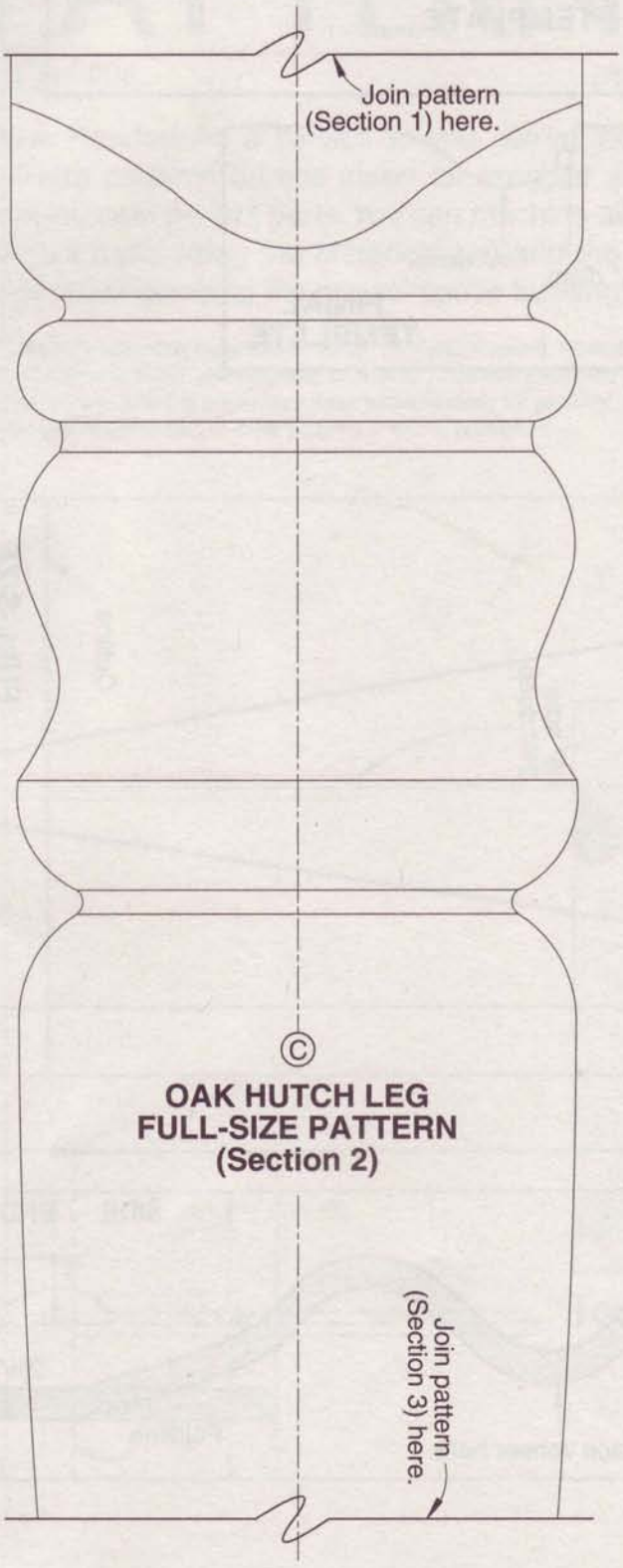
**Ribbon Clock**
**Page 82**

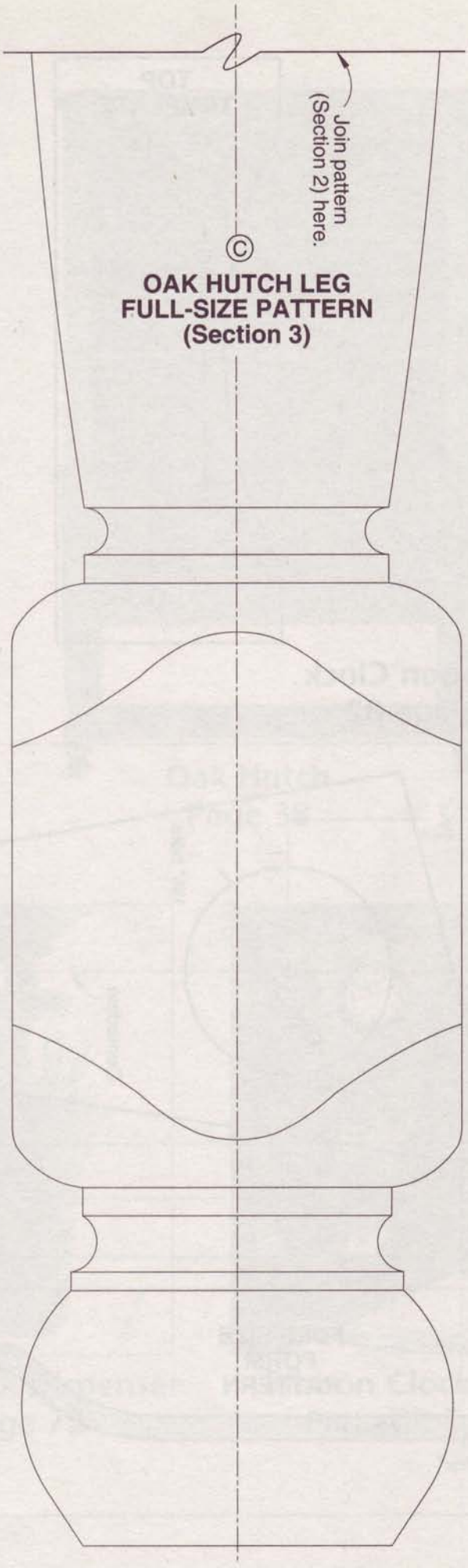


# Oak Hutch
# Page 38

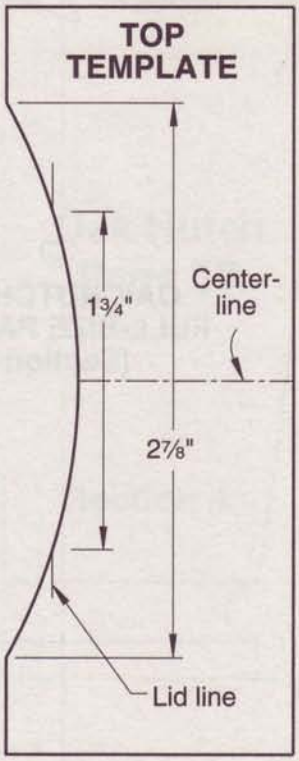


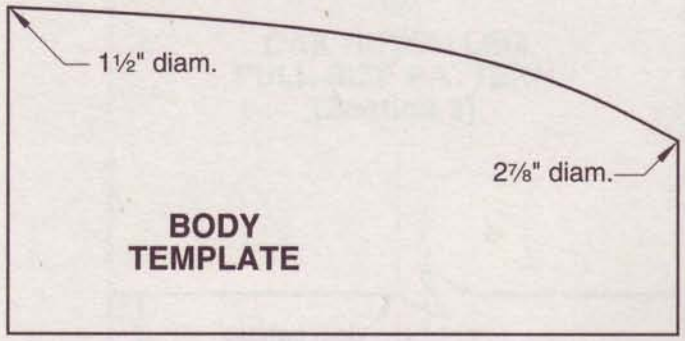



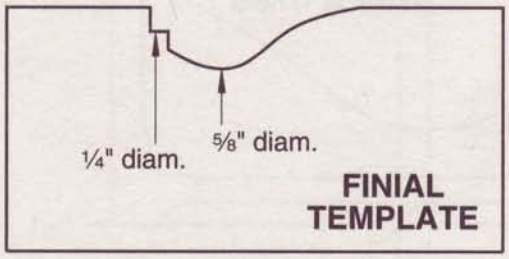

Join pattern
(Section 1) here.
©
OAK HUTCH LEG
FULL-SIZE PATTERN
(Section 2)
Join pattern
(Section 3) here.


Join pattern
(Section 2) here.
©
OAK HUTCH LEG
FULL-SIZE PATTERN
(Section 3)

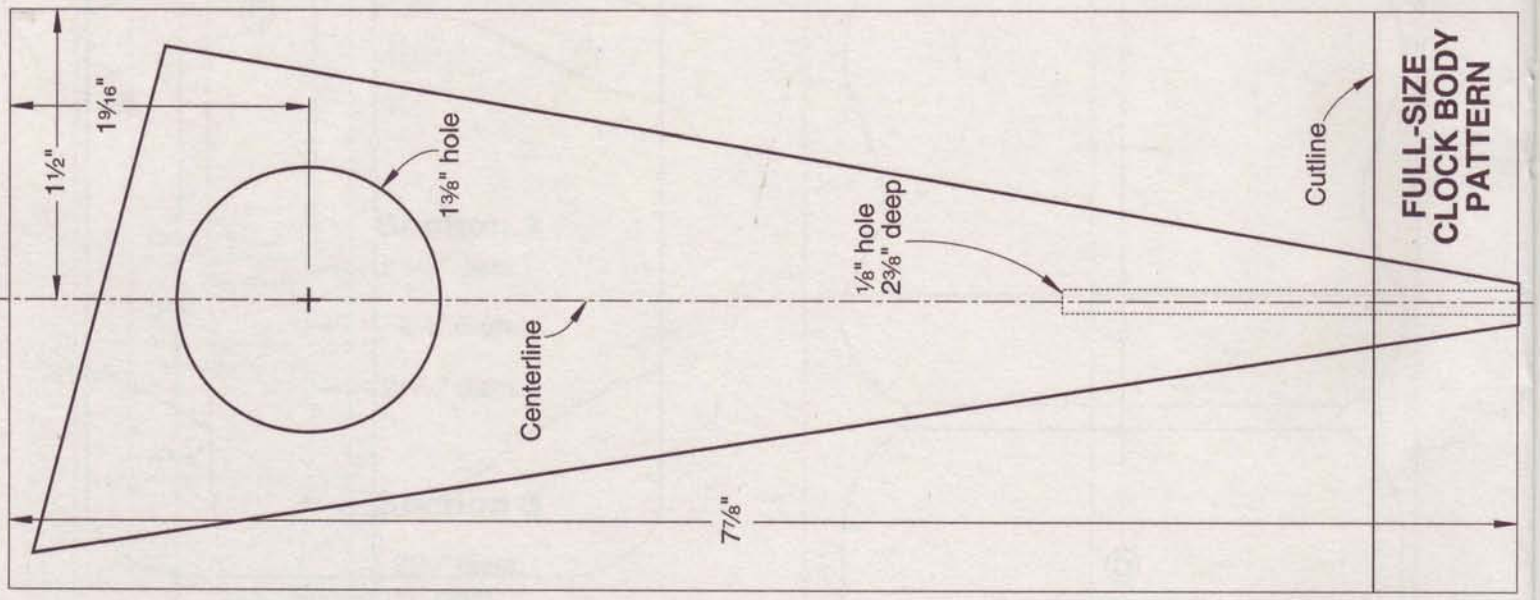
## Toothpick Dispenser
## Page 72

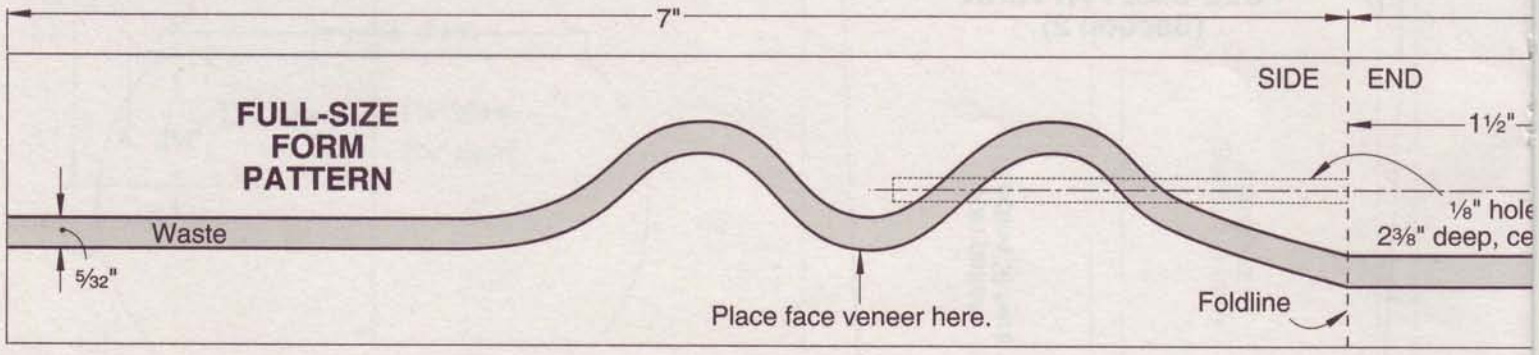



## Ribbon Clock
## Page 82



# Using Ready-Made Project Parts

**To buy or not to buy? That is the question. Manufactured wood parts open new design possibilities, save you time, and maybe even save money.**

Because turning and carving require special equipment and skills, most woodworkers avoid projects with turned and carved parts. It shouldn't be that way. Manufacturers have the machinery and expertise to produce high-quality, perfectly matched wood components in a wide variety of styles, sizes, and species. Most parts are kept in stock and ready to ship. And a quick Internet search revealed that in many cases, a 3×3×36" turning square costs more than a manufactured leg!

While shopping for legs for the hutch on *page 38* and the drop-leaf table in our previous issue, we talked to leading manufacturers of furniture parts. What we learned will help you immeasurably the next time you consider factory-made parts.

An automatic carving machine turns glued-up blanks into table pedestal legs at Adams Wood Products. Note the shiny metal pattern leg toward the back of the first photo.

### HOW LONG IS A LEG?

Browsing the manufacturers' Web sites or looking in their catalogs, you'll see legs offered in different lengths. Here's a guide to the lengths you'll need for different uses.

| TYPICAL LEG LENGTHS | |
|---|---|
| Chair | 16" |
| Coffee table | 18" |
| End table | 21" |
| Dining table | 29" |
| Counter-height kitchen island | 34½" |
| Bar-height kitchen island | 42" |

## Are manufactured parts as good as those I'd make?

The more pieces glued up to make a blank for a part, the greater the chance that variations in color and grain will detract from the beauty of your finished project. Manufacturers generally make turnings up to 2¾" diameter from a single piece of solid stock. Thicker parts are made from glued-up blanks. There are some exceptions, so it's best to ask whether the parts you order are solid stock or glue-ups.

Manufacturers tell us they make every effort to keep grain defects, sapwood in cherry and walnut, and dark heartwood and mineral stains in maple to a minimum. Of course, with lumber coming from smaller trees these days, the larger the diameter of the part, the greater the possibility it will contain a defect. None of the manufacturers guarantees 100 percent clear-grain parts, but undesirable features should be confined to a portion of the part that can be oriented inward, leaving a flawless face for show.

Parts are shipped finish-sanded, but you should carefully inspect them before applying a finish. You may want to do some spot-sanding. All three manufacturers in the chart on the *next page* will refund the purchase price if you're not satisfied with their products.

## Need something different?

For an extra charge, manufacturers will slice turnings in half or quarters for use as onlays. Turnings also can be V-cut or notched to fit over a case corner. This adds three to five days to delivery time.

The mating of computer (CAD) drawings with computer-controlled machinery means that modifying an existing profile or creating an entirely new one doesn't require a large-quantity order, long lead time, or a vault of money. Although prices are quoted on a case-by-case basis, expect to pay twice the price of a standard profile for a custom one of similar complexity. Allow three to four weeks' lead time for custom work.

## More than just legs

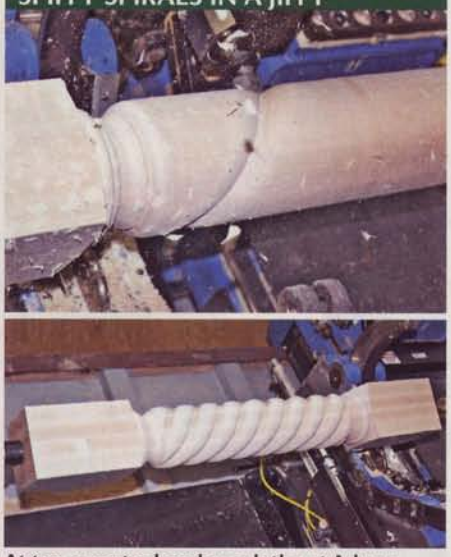
While turned parts constitute the majority of offerings, manufacturers supply a wide variety of other parts, including cabriole legs, square tapered legs, ogee feet, carved corbels, and turning squares. And for really fast project turnaround, some manufacturers sell ready-to-assemble solid-wood furniture kits, including chairs, tables, and vanity bases. The chart at *right* summarizes the products, quality standards, special services, and return policies offered by the three manufacturers we surveyed.

Written by **Jan Svec**
Photographs: **Keith Chamberlin/FLEK Design, Doug Myers, Matthew Osborne**

### CHOOSE ONE FROM COLUMN A

A lathe operator at Classic Designs by Matthew Burak turns out a cartload of identical Doric columns.

### SPIFFY SPIRALS IN A JIFFY



At *top*, a router head on a lathe at Adams Wood Products begins carving. The finished leg *above* sports perfectly formed spirals.

### IN STOCK AND READY TO SHIP

For fast order turnaround, manufacturers keep hundreds of parts in stock, like these at Osborne Wood Products.

### THE FINISHING TOUCH

A technician at Osborne Wood Products finish-sands a spiral column on a brush-sanding wheel.

| | |
|---|---|
| Products | Appliqués |
| | Ball-and-claw legs |
| | Bedposts |
| | Billiard table legs and subrails |
| | Bun feet |
| | Cabinet legs |
| | Chair legs |
| | Columns |
| | Corbels |
| | Finials |
| | Furniture kits |
| | Hardware |
| | Legs and columns for kitchen islands and cabinets |
| | Ogee bracket feet |
| | Pilasters (split onlays) |
| | Profiles by linear foot |
| | Queen Anne and cabriole legs |
| | Round table aprons |
| | Shaker legs |
| | Sofa legs |
| | Square tapered legs |
| | Table pedestals and pedestal legs |
| | Turned coffee, dining, and end table legs |
| | Turning squares |
| Wood species | |
| Quality standards | Solid or glue-up |
| | Sapwood |
| | Sanding |
| Special services (Extra charges apply.) | |
| Return policy | |
| Contact | |
| Online ordering | |

## PROFILES OF MAIL-ORDER FURNITURE PART MANUFACTURERS

| | Adams Wood Products | Classic Designs by Matthew Burak | Osborne Wood Products |
|---|---|---|---|
| | No | No | Yes |
| | Yes | Yes | No |
| | Yes, plus robe rails | Yes | No |
| | Yes | No | No |
| | Yes | Yes | Yes |
| | Yes | Yes | Yes |
| | Yes | No | No |
| | Yes | Yes | Yes |
| | Yes | No | Yes, including corbels for kitchen islands and cabinets |
| | Yes | Yes | Yes, plus balls |
| | Chairs, occasional tables | Vanity bases, chairs, dining and occasional table bases | None |
| | Bed bolt covers, brass cup casters, brass drawer pulls, dowel screws, hanger bolts, leg toe caps, table corner brackets, wood table slides | Wood table corner braces and mounting hardware, wood table slides | Dowel screws, hanger bolts, table corner brackets |
| | Yes | Yes | Yes |
| | No | Yes | Yes |
| | Yes | Yes | Yes |
| | None | Ogee trim molding; ogee foot, apron, and square peg stock | Ogee foot stock |
| | Yes | Yes | Yes |
| | No | Yes | No |
| | No | Yes | No |
| | Yes | No | Yes |
| | Yes | Yes | Yes |
| | Yes | No | Yes |
| | Yes | Yes | Yes |
| | Yes | Yes | No |
| | Alder, cherry, hickory, mahogany, maple, oak, pine, walnut, paint grade. (All products are not available in every species.) | Alder, cherry, mahogany, maple, oak, pine, walnut | Alder, birch, cherry, hickory, mahogany, maple (hard and soft), oak, pine, walnut, paint grade. (All products are not available in every species.) |
| | All turnings are solid stock up to 2¾" in diameter, with some maple turnings solid up to 3½" diameter. Glue-ups are color-matched. | All turnings are solid stock up to 2¾" in diameter, with a significant number solid up to 3½" in diameter. Glue-ups are color- and grain-matched. | All turnings are solid stock up to 2¾" in diameter. |
| | Some sapwood in cherry is allowed, but kept to a minimum. Cherry parts with too much sapwood and off-color maple parts are sold as paint grade. | Some sapwood in cherry is allowed, but kept to a minimum. Sapwood should not encroach on the two-thirds of the leg that constitutes the show face. | Maximum of 25 percent sapwood in cherry and mineral streaking in maple is allowed. |
| | Parts are finish-sanded and ready to use. | Parts are finish-sanded and ready to use. | Parts are finish-sanded and ready to use. |
| | Counter-height legs can be split in half or quartered for use as onlays, and V-cut to fit over a corner. Allow three to five business days extra for these services. Modification of stock profiles and complete custom turnings are available. | Any symmetrical leg or column can be split in half or quartered for use as onlays, or V-cut or notched to fit over a corner. Square top posts and stretcher posts can be full-, three-quarter-, or quarter-rounded. Legs can be mortised, and aprons tenoned. Allow three to five business days extra for these services. Modification of stock profiles and complete custom turnings are available. | Counter-height legs can be split in half or split diagonally for use as onlays, and V-cut to fit over a corner. Modification of stock profiles and complete custom turnings are available. Allow three to four weeks for custom turnings. One-week rush orders available for an additional charge. Two- and three-dimensional CAD drawings of legs available for download from the Web site. |
| | Return in original condition with original invoice within 30 days for exchange or refund. Must call for authorization. After 30 days, returns subject to a 15% restocking charge, plus cost of return freight. No returns after 90 days. | Return within 30 days for a refund of the purchase price. | Return in original condition and packaging within 30 days for refund of the purchase price. Should the problem occur due to system or clerical error, regular shipping costs refunded. |
| | 423-587-2942, adamswoodproducts.com | 800-843-7405, tablelegs.com | 800-849-8876, osbornewood.com |
| | No | Yes | Yes |

# Arrange-to-Please Sectional Tables

**Talk about rearranging the furniture! Square 'em up or string 'em along. These easy-to-build tables reconfigure as your needs change.**

See a Slide Show of this project coming together at woodmagazine.com/slides

## PROJECT HIGHLIGHTS

- Overall dimensions: 18" square × 18" tall.
- We made the tables from cherry and cherry plywood. But oak, walnut, or mahogany also makes a good choice.
- As an alternative to ¼" tempered glass in the top frame, you can install an MDF panel with a decorative overlay. See the sidebar, "3 great top options in 5 easy steps," *page 62*.

### Skill Builder

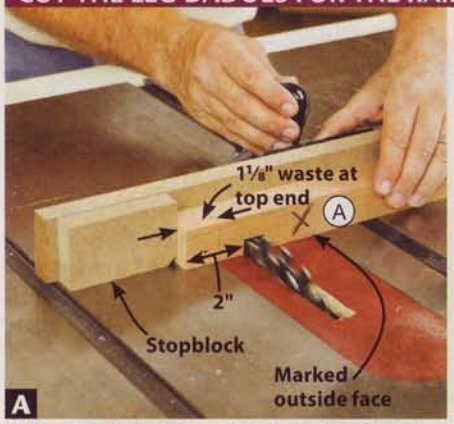
- Learn how to make rails that install flush with the outside faces of table legs using a unique notched miter joint.

## First up: the legs and rails

**1** From laminated ¾" cherry or solid stock, cut the legs (A) and rails (B) to the thickness and width listed [**Materials List**, *page 63*] and 19⅛" long. For precise-fitting joints, plane the legs and rails to exactly 1¼" square. (You'll crosscut the legs to the finished length of 18" after machining the dadoes to receive the rails.) Trim the rails to the finished length of 18" by miter-cutting both ends.

**2** To avoid a machining error, mark the two *outside* faces of each leg (A) at both ends where you'll cut the 1¼" dadoes ⅝" deep 2" from the ends [**Drawings 1** and **2**]. Also, draw lines 1⅛" from the top ends of the legs for cutting off the waste. Using a ¾" dado blade in your tablesaw and an

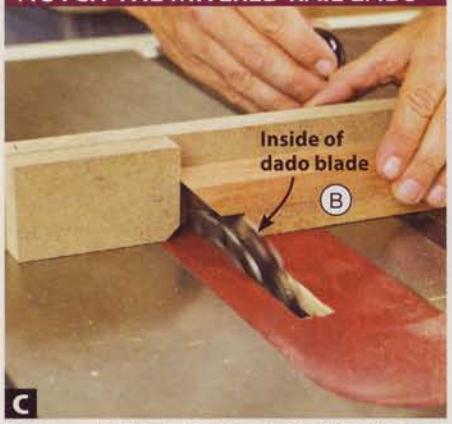
## CUT THE LEG DADOES FOR THE RAILS IN TWO EASY STEPS




With a leg (A) tight against a stopblock, cut a ¾" dado ⅝" deep 2" from the end into the two marked faces. Repeat at the other end.

Move the stopblock away from the blade as needed to widen the dadoes to 1¼". Repeat the cutting sequence to complete the joints.

## NOTCH THE MITERED RAIL ENDS




Using a stopblock to align the *inside* of your dado blade with the heel of the miter-cut end of a rail (B), cut a ⅝×⅝" notch into each end.

extension with a stopblock attached to the miter gauge, form the dadoes [**Photos A** and **B**] to precisely fit the rails (B).

**3** Crosscut the legs (A) to the finished length of 18" at the marked lines at the top ends. Then, using a backer board attached to a miter gauge on your router table to keep the legs square to the fence and prevent tear-out, rout a ⅛" round-over around the top and bottom ends of the legs [**Drawing 1**]. Sand the legs to 220 grit.

**4** Using your dado blade, cut a ⅝" notch ⅝" deep into the mitered ends of each rail (B) [**Drawings 2** and **2a**, **Photo C**]. For help with this to ensure a perfect fit into the dadoed legs (A), see *page 18*.

**5** To assemble the table, glue and clamp a top and bottom rail (B) into the dadoes in a pair of legs (A) [**Photo D**], checking for square. Remove any glue squeeze-out from the joints and mitered ends of the rails. Repeat for the other pair of rails and legs. Then, glue and clamp the remaining top and bottom rails to the two leg/rail assemblies [**Photo E**].

## Add the shelf and top

**1** Cut the shelf supports (C) and glass supports (D) to the sizes listed. Sand smooth. Set the glass supports aside.

**2** Cut the plywood shelf (E) to size to fit inside the bottom rails (B). Then, cut a ⅛" rabbet ⅛" deep around the shelf on the *top* face [**Drawing 2**]. Sand the shelf, using care not to go through the thin veneer.

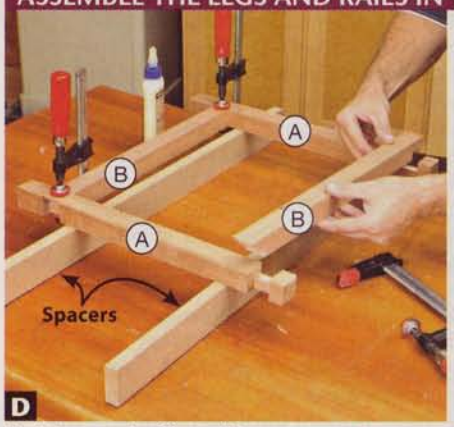
**3** To position the shelf supports (C) on the *inside* faces of the bottom rails (B) so that the top of the shelf (E) is flush with the *top* edges of the rails, cut a 2×10" spacer from your ¾" plywood or other scrap of the same thickness. Place the table with the bottom up. Then, glue the supports to the rails in a butt-joint configuration [**Drawing 2**], using the spacer to position them [**Photo F**]. Now, glue and clamp the shelf to the supports.

**4** Cut the top frame sides (F) to size. Using your dado blade and a stopblock clamped to your rip fence, cut a 2½" rabbet ⅜" deep at each end of the sides on *opposing* faces to form the half-lap joints [**Drawings 2** and **2b**, **Photo G**].

**5** Glue and clamp the top frame sides (F) together, verifying tight lap joints and square.

**6** Using a fence and stopblock on your bandsaw, cut into each corner of the frame to form a 1⅜×1⅜" notch [**Draw-**

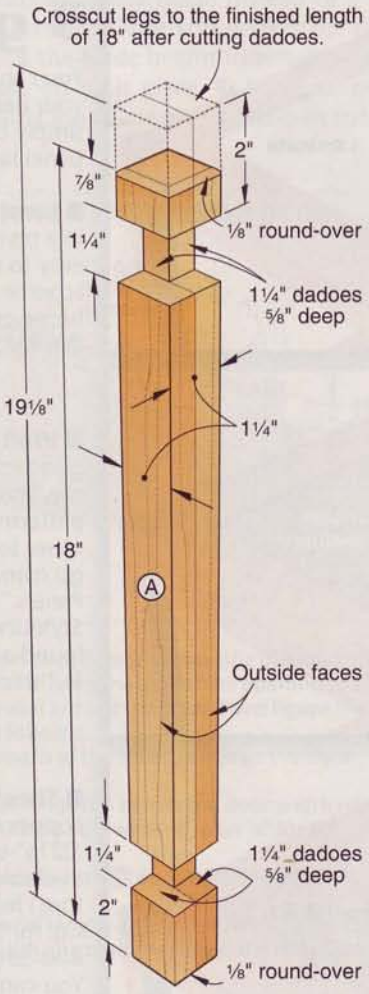
## ASSEMBLE THE LEGS AND RAILS IN TWO STAGES

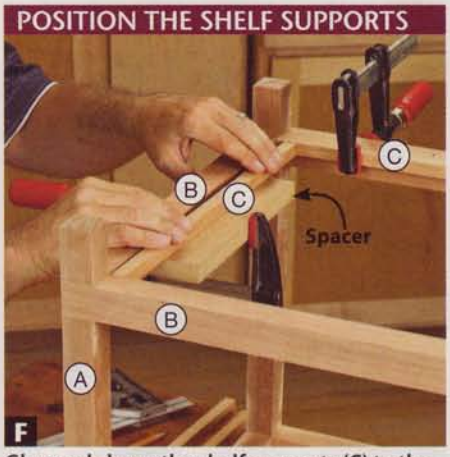



Position a pair of legs (A) on spacers to provide clamp clearance. Glue and clamp a top and bottom rail (B) into the leg dadoes.

With the two leg/rail assemblies (A/B) upright, glue and clamp the remaining top and bottom rails (B) into place.

**1 LEG**






Glue and clamp the shelf supports (C) to the bottom rails (B), using a spacer clamped flush with each rail *top* to position the support.

After making an initial cut to rabbet the ends of a top frame side (F), move the side away from the stopblock to complete each rabbet.

**ings 2** and **2b**, **Photo H**]. Flip the frame over, remove the stopblock, and cut each corner again to complete the notch [**Photo I**].

**7** Using your dado blade, cut a ⅛" rabbet ⅛" deep around the outside edges of the frame (F) on the *bottom* face [**Drawing 2**]. Sand smooth.

**8** Position the frame on a flat worksurface with the *top* face up. Then, glue and clamp the glass supports (D) to the inside edges of the frame, flush with the bottom.

## Finish up

**1** Finish-sand any areas that need it to 220 grit. Remove the dust.

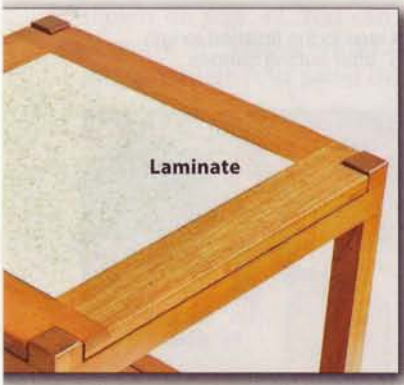
**2** For ease of finishing, mask the mating glue-joint areas on the frame (F) and top rails (B) using ¾"-wide easy-release painter's tape [**Photo J**]. (You'll glue the frame to the rails after finishing.) Also, if you plan to install an optional MDF top with decorative overlay instead of the glass, mask the top faces of the glass supports (D).

**3** Apply a stain, if you wish, and a clear finish. We applied Varathane Premium Gel Stain, no. 445 Traditional Cherry, followed by two coats of a water-based clear satin polyurethane, sanding to 320 grit between coats.

**4** Remove the masking tape from the top rails (B) and frame (F). Then, glue and clamp the frame to the rails with the outside edges flush. To prevent damaging the finish, use protective clamp pads and apply light pressure.

**5** Finally, have a piece of ¼" tempered glass cut to 13" square. Move the table(s) to the desired location, and place the glass in the frame(s). Now round up some treats and do a little munching to celebrate your handiwork.

Written by **Owen Duvall** with **Jeff Mertz**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine**; **Lorna Johnson**



# 3 great top options in 5 easy steps

You can customize the table to perfectly match your decor—or to create a striking accent—simply by replacing the glass with an MDF panel laminated with a decorative overlay.

■ **Laminate** – Plastic laminates are available in a myriad of colors and patterns, making it easy to coordinate with your decorating scheme. You'll find laminates at your local home center. Shown at *left*: Wilsonart WIL4575 Mesa Pearl Textured Gloss.

■ **Wall paneling** – Think that this sheet good comes only in wood tones? Not so. You can find the paneling in a variety of colors, patterns, and textures at home centers and other sources. To find a source near you, go to gp.com/build and click on "Decorative Finish Panels." Shown at *left*: Georgia-Pacific StyleLine Panel Coffee Bean Leather. (We found a 4×8' sheet of this approximately 3/16"-thick material for less than $20.)

■ **Sheet metal** – Go thin and flashy with a copper or an aluminum overlay. We used .0216"-thick, 16-ounce soft copper sheeting, available in a 14×60" roll (enough for four tops) from the Storm Copper Components Co. for $56.47 ppd. Call or click 800-394-4804; stormcopperstore.com. You can find aluminum flashing at your home center.

**Step 1** Cut a 14"-square piece of ½"-thick MDF to make a substrate for your selected overlay material.

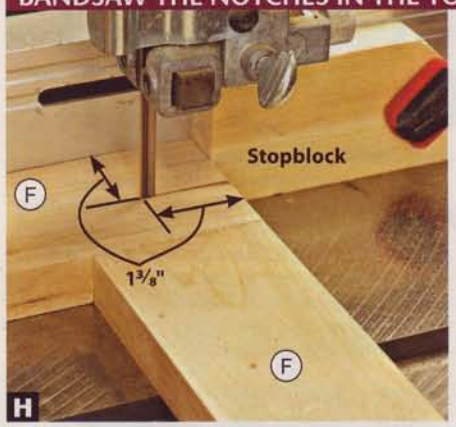
**Step 2** Adhere the overlay to the MDF. For laminate or wall paneling, use contact cement (no clamping needed). Use a polyurethane glue to bond sheet metal to the MDF. (We used Liquid Nails Rhino Ultra Glue.) To ensure strong adhesion, place a piece of waxed paper and another 14"-square piece of MDF on top of the metal and clamp the assembly together. The waxed paper prevents glue squeeze-out from adhering the top MDF to the metal.

**Step 3** For a metal overlay, polish the metal by hand-sanding with 220-grit sandpaper or a medium 3M Scotch-Brite pad, creating a fine scratch pattern in a straight or an angled direction, as you wish. Or, use a random-orbit sander to produce a swirl pattern. For a rustic look, peen the metal with a hammer. To preserve the sheen, spray the metal with two coats of a clear, water-based polyurethane.

**Step 4** To ensure a snug fit of the top in the frame (F), measure the opening. (Ours measured 13" square.) Then, using your tablesaw with a carbide-tipped blade, trim the top to size.

**Step 5** Place the top in the frame (F), tight against the glass supports (D). Next, measure the offset between the tops of the frame and the top. Now, rout a ⅝" rabbet to a depth equal to your measurement into the bottom of the MDF along the edges. To ensure a flush top, make several passes with small depth increments as you approach the final depth, checking the fit after each pass.

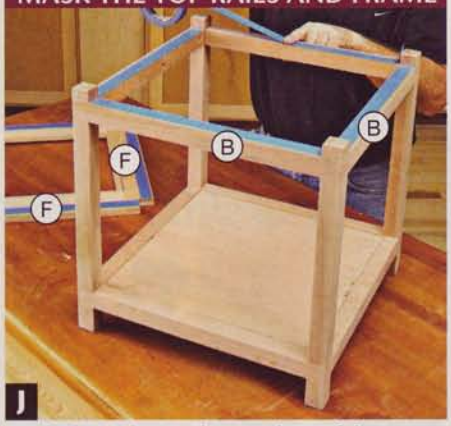
## BANDSAW THE NOTCHES IN THE TOP FRAME CORNERS




H With your bandsaw fence positioned 1⅜" from the *outside* of the blade, make a 1⅜"-long cut into each corner of the frame (F).

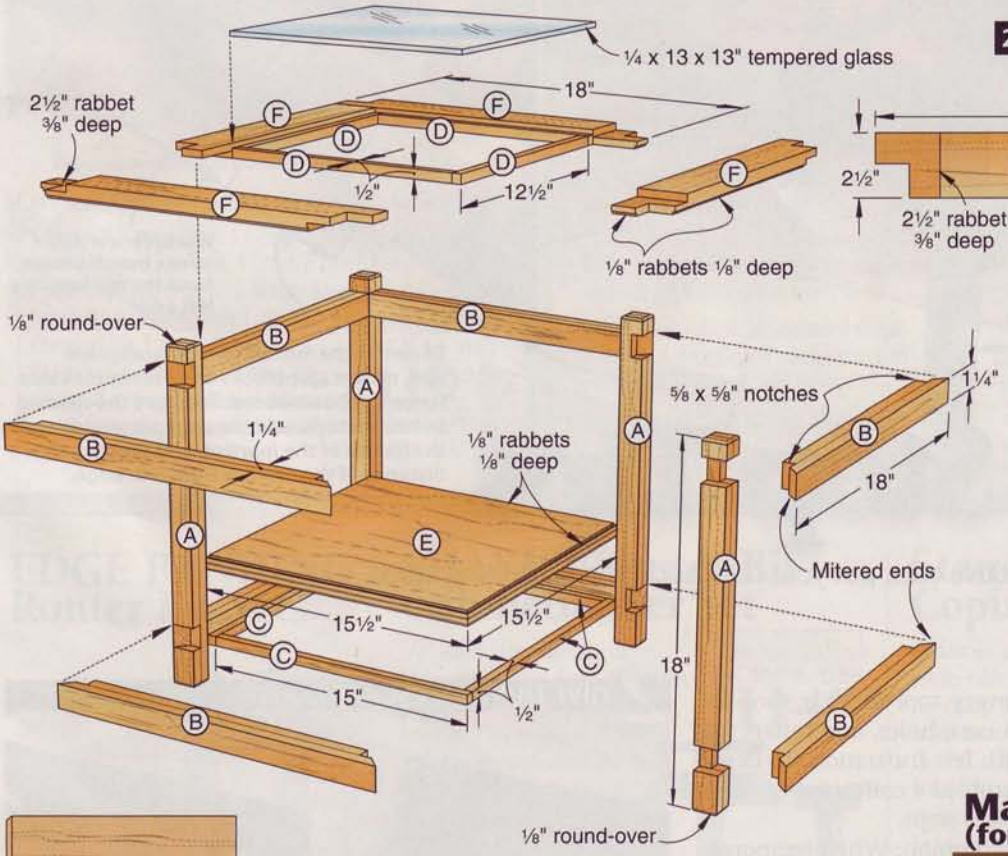
I Remove the stopblock to prevent a trapped cutoff. Turn over the frame, and bandsaw each corner again to complete the notch.

## MASK THE TOP RAILS AND FRAME

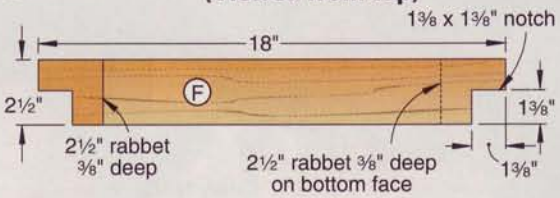



J Mask along the *inside* top edges of the top rails (B) and the rabbeted edges on the *bottom* face of the frame (F).

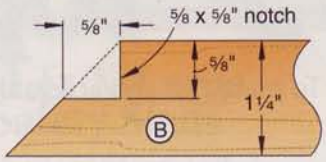
## 2 EXPLODED VIEW



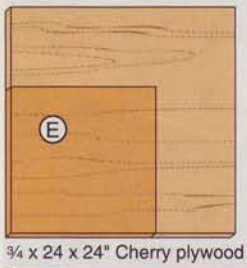

## 2b TOP FRAME SIDE (Viewed from top)



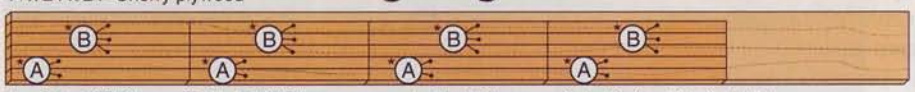

## 2a RAIL DETAIL (Viewed from top)




## Cutting Diagram




¾ x 24 x 24" Cherry plywood




¾ x 7¼ x 96" Cherry (5.3 bd. ft.) *Plane or resaw to the thicknesses listed in the Materials List.

¾ x 5½ x 96" Cherry (4 bd. ft.)

## Materials List (for one table)

| Part | | FINISHED SIZE T | W | L | Matl. | Qty. |
|---|---|---|---|---|---|---|
| A* | legs | 1¼" | 1¼" | 18" | LC | 4 |
| B* | rails | 1¼" | 1¼" | 18" | LC | 8 |
| C | shelf supports | ½" | ½" | 15" | C | 4 |
| D | glass supports | ½" | ½" | 12½" | C | 4 |
| E | shelf | ¾" | 15½" | 15½" | CP | 1 |
| F | top frame sides | ¾" | 2½" | 18" | C | 4 |

*Parts initially cut oversize. See the instructions.

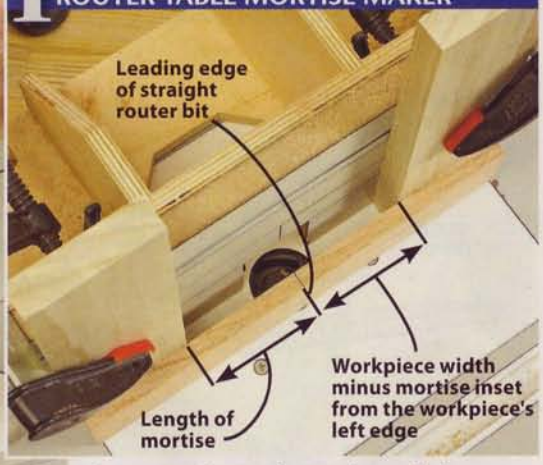
**Materials key:** LC–laminated cherry, C–cherry, CP–cherry plywood.

**Supplies:** ¾"-wide easy-release painter's tape, ¼x13x13" tempered glass.

**Blade and bit:** Dado-blade set, ⅛" round-over router bit.

This double stopblock with connecting safety fence ensures identical mortises. Plunge the workpiece down along the edge of the right-hand stopblock using a pushpad, as shown at *left*, to start the mortise. Then feed the workpiece to the left through the cut until it bumps the left-hand stopblock. Finally, raise the workpiece along the edge of the left-hand stopblock.

## 1 ROUTER-TABLE MORTISE MAKER




To center the mortise on the workpiece end, mount stopblocks on your router-table fence, as shown *above*. To figure the spacing between stops, add the workpiece width to the length of the mortise, and subtract the distance of the mortise from one edge.

# 9 Top Stop Tips

To make fast and accurate repetitive cuts, put your ruler aside and start using stops.

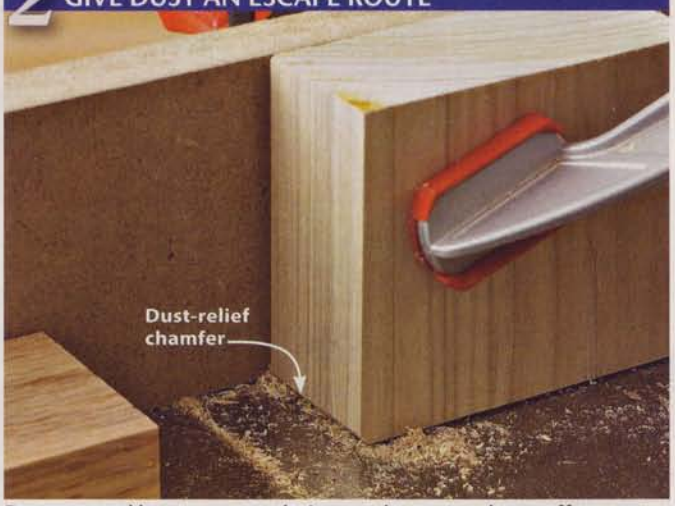
Stops can be used on nearly every tool in your shop to precisely position and control cuts, holes, and miters for greater speed and accuracy with less frustration. To demonstrate their versatility, we've assembled a collection of ways that stops can speed repetitious project steps.

These stops all have one thing in common: When temporarily attached to saws, router tables, or drill presses, they limit the movement of workpieces or fences so you get consistent results time after time. Although you can buy stops or use clamps, most stops can be made using scrapwood.

When making your own stops from blocks of wood, like the one shown at *right*, be sure to cut a "relief" chamfer or rabbet where indicated to prevent sawdust buildup from changing the position of the stop. Even with that precaution, remember to periodically brush or blow debris away from the stop.

When assembling stops with more than one part, like the router-table double stop shown *above*, avoid using nails or screws that might accidentally come into contact with a saw blade or router bit. Check clamp positions to ensure they won't touch your blade or bits.

## 2 GIVE DUST AN ESCAPE ROUTE

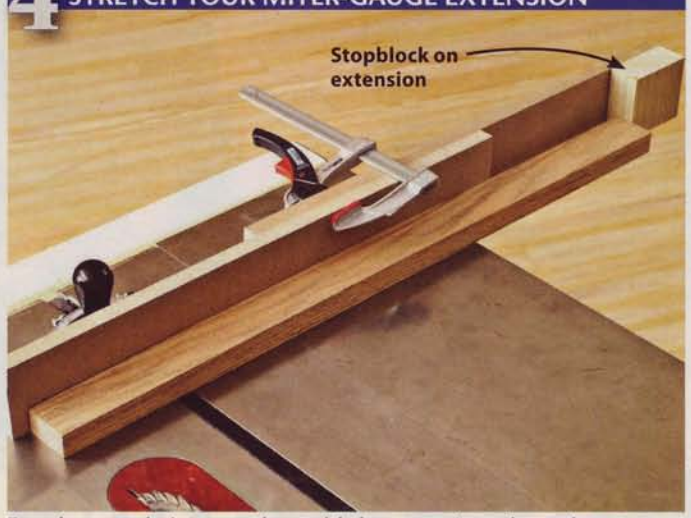



Dust trapped between a workpiece and stop can throw off your precision. Cutting a ⅛" chamfer on the bottom edge of a stop allows dust a place to go between cuts.

## 3 ADD SPACERS TO A SINGLE STOP

If you're boring a series of holes on a drill press, place the stopblock to make the first hole. Then use scrapwood spacers cut to lengths equal to the spacing between the holes to be drilled, in this case 4" and 6" from the stopblock.

## 4 STRETCH YOUR MITER-GAUGE EXTENSION




Even long workpieces, such as table legs, consistently can be cut to length using stops. For parts longer than your miter-gauge extension, attach a stopblock to a long, rigid piece of scrap. Then, measure from the blade to the block, and clamp the stop to your extension.

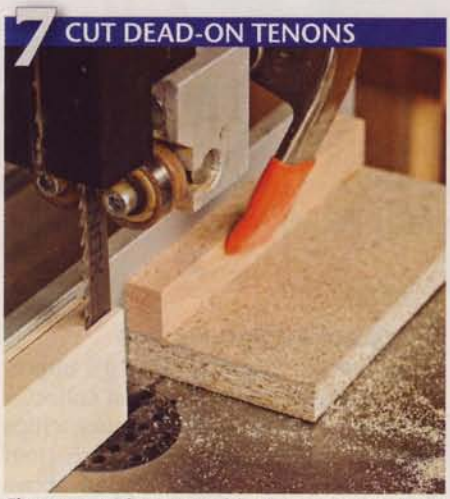
## 5 ANGLED STOPS KEEP MITERS LOOKING SHARP

When cutting miters, bevel your stopblocks to complement your workpieces. The angled stop gives you more solid contact, and you won't blunt the tips of your mitered ends.

## 6 DOUBLE UP ON SAW-FENCE STOPS

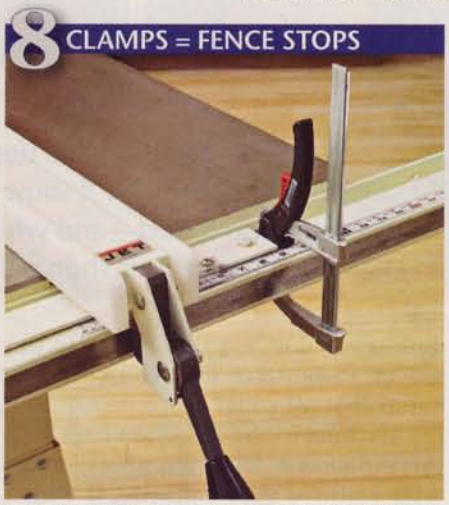
Whether you buy or make a basic fence stop, tailor it to work around obstacles, such as motors. When that's not possible, give yourself the versatility of being able to cut on either side of the blade or bit.

## 7 CUT DEAD-ON TENONS



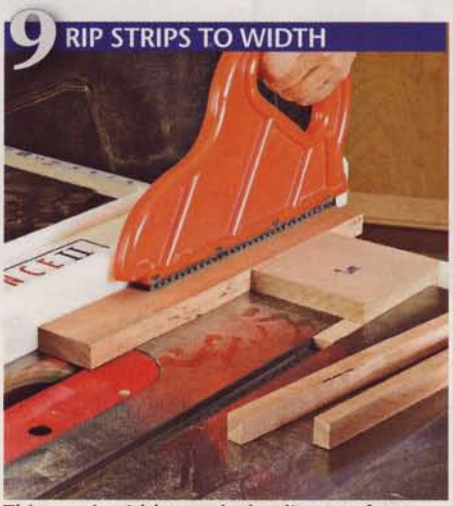
Clamp an L-shape stopblock to your bandsaw fence to cut tenon cheeks to length. To cut the tenon shoulders, leave the stopblock in place and adjust the fence. Make the blocks long enough that the clamp doesn't interfere with the upper roller guide.

## 8 CLAMPS = FENCE STOPS



Sometimes, you need to move your tablesaw fence closer to the blade, and then return it to the same position—when switching between crosscut and dado blades, for example. A clamp attached to the fence rail serves as a stopblock for the fence's return trip.

## 9 RIP STRIPS TO WIDTH



This stop's width equals the distance from the edge of the blade nearest the stop to the far edge of the slot minus the width of strips to be cut. After each cut, slide the fence until the workpiece touches the edge of the stop; then cut the next strip.

SHOP-TESTED

# Dust Collectors Under $400

*WOOD*® magazine tester Jeff Hall adjusts the funnel on the end of the duct to create resistance during airflow testing.

Watch a FREE video explaining how the testing rig works and how we create a fan curve at woodmagazine.com/dctest

**There's more to dust collection than just sucking up debris. We'll show you which machines do it best—and which ones return less fine dust to your shop's air.**

Would you buy a dishwasher that didn't actually clean your plates and pots? How about a lawn mower that cuts only half the blades of grass it passes over? Of course not. You expect machines to perform their tasks.

We're with you. And that's why we say you should not spend your hard-earned money—and risk your health—on a dust collector that fails to trap fine dust—even dust too fine to see. In our test of 15 portable dust collectors, we found that all could move debris from the machine to the collection bags with varying success. However, nine of those units featured dust-capturing filtration so inferior, they merely recirculated much of the fine dust back into the air. And it's that breathable dust that medical studies have proved to be the most harmful to your health.

## Dust collector basics

Before we get into filtration, it's important to understand how a dust collector works. The type we tested suck chips and dust into an impeller, which then spews them into bags strapped above and below a steel rim. The bottom bag collects what settles, while the top bag (and unfilled areas of cloth bottom bags) filters and traps the dust as air escapes through it.

A dust collector needs to move dust and chips at least 3,500 feet per minute to keep them suspended in the air and prevent them from settling in the duct. Multiplying the air speed by the area of the duct gives you cubic feet per minute (CFM), the performance spec cited most often in dust-collection discussions. Typical home woodworking machines have 4" dust ports and require a minimum airflow of 400 CFM.

But CFM is only one of two key factors in gauging dust-collector performance. The other is resistance, measured in inches of static-pressure loss. The very ductwork you need to channel the debris to the collector actually chokes that airflow, especially as you add length or change directions. For example, every elbow, wye, or reducer in your line creates resistance versus a similar setup with a straight duct of one size. The length of duct and material it's made of also adds resistance. (Ribbed flex-hose, for example, adds three times the resistance of smooth-walled metal duct, so it's important that you use as little of it as possible.)

## We went high-tech to test these collectors

With assistance from Dr. Greg Maxwell of Iowa State University's engineering department, we created a testing apparatus using smooth-walled metal ductwork that we attached to each collector's port (shown at *left*). On the open end, we used a funnel-shaped stopper, threaded to an anchored bolt, to simulate different lengths and shapes of ductwork.

We utilized a pitot tube and manometer inside the duct to measure airflow (CFM) and resistance in inches of static-pressure loss (SP). These figures help pinpoint which collector will work for you. To determine the amount of SP loss you should expect to encounter, go to woodmagazine.com/spcalc, or read issue 119 (December 1999), pages 16–18.

Of the 15 units we tested, 11 have 6" inlet ports and the rest have 5" ports. All models come with a wye that mounts over the inlet and allows you to attach two 4" ducts. (All have a cap so you can close one of the 4" ports.) We tested each unit with 4" metal duct for a true apples-to-apples comparison (see chart at *right*), and also tested them with 5" or 6" duct to match their ports (*next page*). We found that each machine achieved greater suction with less resistance using the larger-size duct. (Using 5" and 6" duct or flex-hose, however, requires a greater minimum CFM level than 4" duct to keep debris in suspension.) If you intend to use 4" duct or flex-hose with a wye, plan to add blast gates near that wye so you can close off one duct while using the other. Leaving both open cuts your machine's suction capability in half.

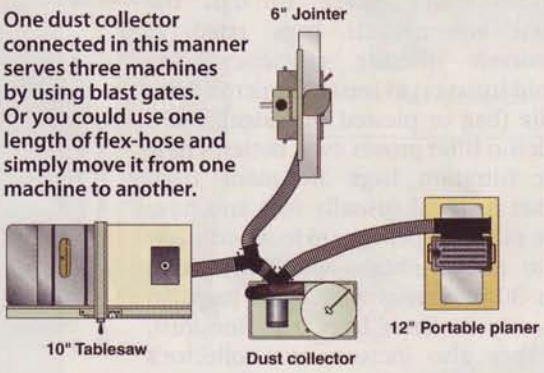
# Know your dust-collection needs

How do you translate the values for airflow and resistance into finding the right dust collector? Start by determining how many machines you plan to hook up. If you're looking to install a duct system that will service your whole shop, these machines will not work for you. They're meant for short duct runs or dedicated hook-ups to only a few machines. (See the illustration at *right* for a simple three-machine setup.) For a central system, you'll need a more powerful dust collector or a cyclone.

The machines in this test have 1½- and 2-hp motors, but to find out how less-potent dust collectors perform, we included a typical 1-hp unit in our testing. It did not fare well, failing to meet the 400 CFM minimum, as shown in the chart *below*. You might have luck using one of these units with a very short duct (6' or less), but you'll likely leave some debris behind.

### TYPICAL SHOP SETUP FOR A PORTABLE DUST COLLECTOR

One dust collector connected in this manner serves three machines by using blast gates. Or you could use one length of flex-hose and simply move it from one machine to another.

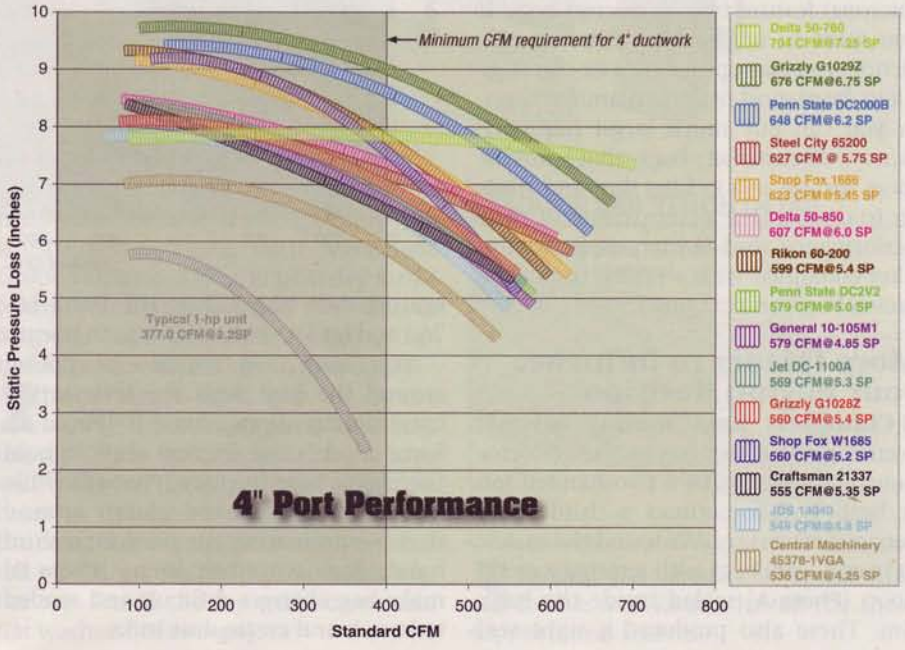



## Filtration proves critical for you and the collector

Wood debris ranges from heavy particles (like planer chips) that quickly fall to the floor, to microscopic dust particles that remain suspended in the air for 30 minutes or longer and can't be seen without magnification. The smallest size

## Two Units Deliver Adequate Airflow Over 8" Static Pressure

**Dust collectors lose CFM as the amount of resistance (SP loss) increases. Select a model that operates at a high CFM rate for a given SP loss for your duct setup. Because you'll need to maintain at least 400 CFM in 4" duct to keep dust and chips in suspension, look for performance results to the right of the shaded area. Peak performance of each dust collector is noted at *right*.**



a human eye can see is about 10 microns. (Human hair, by comparison, measures about 40–60 microns in diameter.)

These dangerous, breathable, ultrafine particles easily escape through the porous woven-cloth bags rated at 30-micron filtering efficiency. You should insist on at least a 5-micron filter media (bag or pleated cartridge), but a 1-micron filter proves even better. These finer filtration bags are made from thicker material (usually felt) and have more pinholes per square foot—to allow air to pass through—when compared with 30-micron woven cloth bags. So not only do these bags trap fine dust, but they also increase the collector's airflow by reducing resistance.

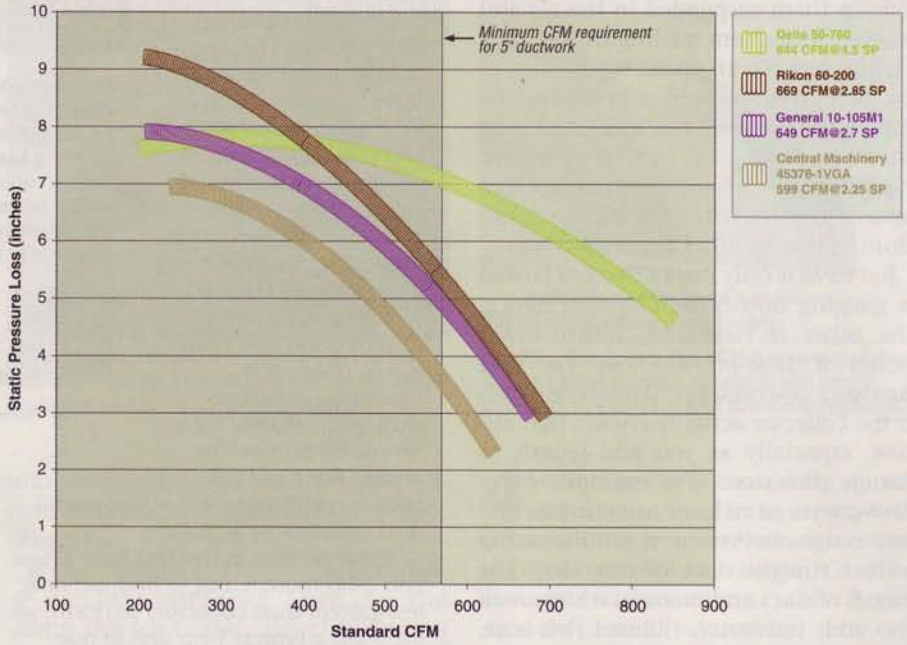
Five of the units we tested come standard with a 1-micron top bag, and of those, Penn State also includes a 1-micron bottom bag on both of its models. The other three (Delta 50-760, JDS 14040, and Steel City 65200) have nonporous plastic bottom bags. Delta's 50-850 comes with a 5-micron top bag and plastic bottom bag.

Ironically, two units—General International's 10-105M1 (2 microns) and Grizzly's G1029Z (2.5 microns)—included fine-filtering top bags but offset them with 30-micron bottom bags that allowed fine dust to escape. After we shared test results with these companies, both elected to replace the bottom bags with plastic, effective immediately. (Grizzly's Bill Crofutt said the company will also replace both 30-micron bags on the G1028Z with a 2.5-micron top bag and plastic bottom bag.)

All other models except Rikon (10 microns) feature two 30-micron bags. If you want to upgrade the filtering efficiency, you can opt for bags or cartridge filters from most of these manufacturers, or you can buy much larger high-efficiency aftermarket bags that provide more surface area to filter dust and allow air to escape. (For a comparison of their performance, read "A high-efficiency top filter combined with a plastic bag below proves best" on *next page*.)

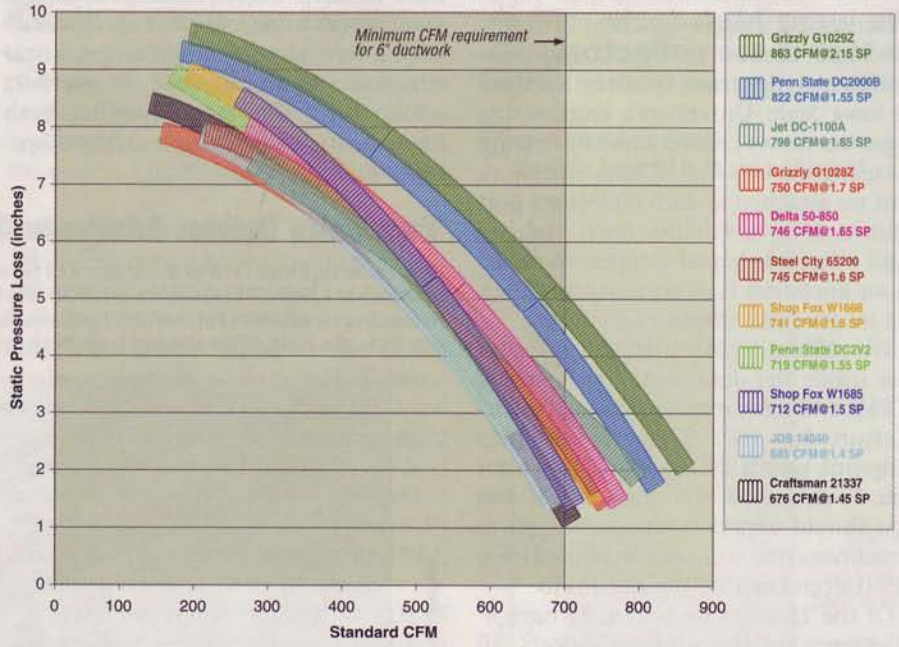
## Delta Stands Out Against 5"-Port Peers

**We tested the four dust collectors with 5" inlets using 5" duct, and the Delta 50-760 clearly outperforms the others. It achieves greater CFM and also overcomes higher SP losses. Peak performance of each dust collector is noted at *right*.**




## Not All Units Can Support 6" Ducts

**Using 6" duct on those units with a 6" inlet, we found that more than half barely reach the minimum CFM level at static-pressure levels less than 3". The Grizzly G1029Z and Penn State DC2000B excel above the others. Peak performance of each dust collector is noted at *right*.**




## More factors to influence your buying decision

■ **Clampless bags mount easiest.** Securing the lower bag to the collector housing proves to be a two-handed job at best, and sometimes a third hand becomes necessary. We found the easiest to install were bags with a springy metal hoop [**Photo A**] sealed inside the bag's rim. These also produced a tight seal against dust leaks. Only the Delta 50-760 and Jet DC-1100A have such hoops.

Next best is a continuous pocket around the bag, with the lever-action band clamp slipped into it [**Photo B**]. Some models use friction clips to hold the plastic bags in place [**Photo C**] while you tighten the band clamp around them—eliminating the need for a third hand. Bags with belt loops [**Photo D**] make bag changes difficult and tended to bunch and create dust leaks.

■ **They're all mobile, but...** Because these dust collectors are portable, they all have four swiveling casters, so you don't have to parallel-park them. But only two units, the Central Machinery and Delta 50-760, include handles for you to guide them around. Some have sturdy legs that bend away from the bottom bag that also serve reasonably well as handles. The majority proved wobbly but strong enough for their purpose.

*(Continued on page 70)*

## BAG MOUNTING METHODS FROM BEST TO WORST

A

Simply twist Delta's metal hoop slightly and it pops loose; put it back with a similar twist.

B

Clamps in sewn pockets that open in only one spot prove easy to use.

C

Metal clips hold plastic bags while you secure the band clamp, which still takes two hands.

D

Bags that rely on belt loops and a band clamp proved the most difficult to install.

# A high-efficiency top filter combined with a plastic bag below proves best

To find out which combination of top filter media and bottom collection bag works best, we tried each option on the Jet DC-1100A. We paired up combinations of the standard 30-micron cloth bags, a plastic lower bag, a 5-micron filter bag (from Jet), a 2-micron cartridge filter (from Jet) [**Photo E**], and a 1-micron oversize bag (from American Fabric Filter, 800-367-3591 or americanfabricfilter.com).

As you see in the chart *below*, using a high-efficiency filter on the top and a nonporous plastic bag on the bottom added 40–80 CFM of airflow versus 30-micron bags. And although stepping up from a 5-micron to a 1-micron bag didn't improve airflow in our test, it will boost your shop's air quality. Some manufacturers told us they get greater airflow with cartridge filters versus standard-size bags. We were unable to test each collector with all filter and bag options.

But finer filtration and increased airflow come at a price. A cartridge typically costs $200–$250, three times as much as a high-efficiency bag. American Fabric Filter (AFF) custom-designs and manufactures oversize 1-micron bags ($60–$160) to fit each customer's dust collector and shop limitations (low ceilings, for example). These bags add filtration surface area, said AFF's Stan Wnukiewicz.

"You've got to have a large enough filter bag that won't inflate tight like a balloon," Wnukiewicz says. "If it does, all that air pressure will force the pores open and allow dust particles through, and that reduces suction. You also have to anticipate what that filter will be like in six months or a year after a lot of use. With pleated filters and porous bags, that dust gets forced into the fabric or pleats to the point where you might never get it out."

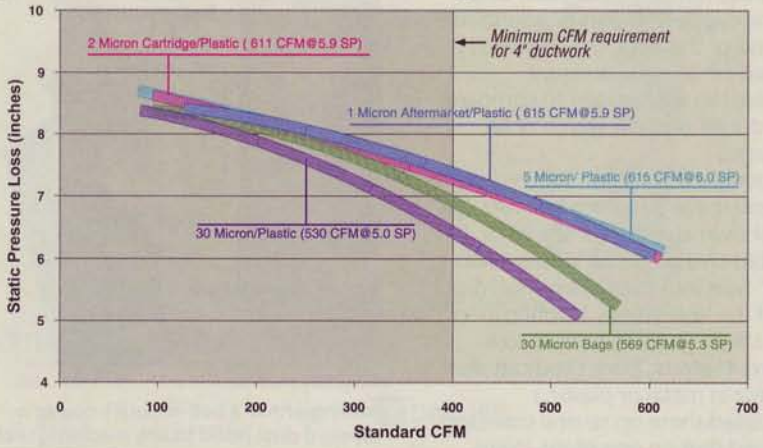
## CARTRIDGE CLEANS QUICKLY

E

Spin the handle of a cartridge filter to turn paddles inside that flip dust off the pleats.

## Fine Filters Increase Airflow and Quality

**Any high-efficiency filter medium paired with a plastic bottom bag gains CFM and overcomes more SP loss than any system using a 30-micron bag. Peak performance of each combination is noted using 4" duct.**




## Dusty trail leads to doctor's office

Tester Jeff Hall learned a tough lesson with wood dust while testing these collectors. Jeff has a sensitivity to walnut dust that gets his nose and sinuses running, but he purposely used walnut dust to season all of the bags before taking airflow and resistance readings, using it as a red flag that a particular machine might be leaking dust. And many of them did leak around fittings and seals. But what Jeff didn't count on was that the units with 30-micron bags actually forced much of the fine dust—including dust too fine to see—back into the air he was breathing. When his nose alerted him, he began wearing a respirator. But it was too late. So much dust got into his lungs that it caused a respiratory infection that lasted three weeks and required three rounds of antibiotics. The lesson: Filtering and trapping dust is critical, so use filtering media on your collector of 5 microns or less.

## IMPELLER TRANSITION FACTORS INTO AIRFLOW

F

The impeller on Delta's 50-760 blows dust and chips directly into the collection chamber without need for a jumper hose.

G

The 6" hose on the Craftsman has a smooth transition from the impeller to the collection and filter bags.

H

The 5" hose on Penn State's DC2V2 bends at almost a 90° angle—creating more resistance—when the impeller is powered.

■ **"Jumper" hose adds resistance.** Fourteen of the 15 collectors we tested have the motor and impeller resting on the base just above floor level. (Only the Delta 50-760 [**Photo F**] has them located at midlevel.) Those 14 machines have 2–3' of flex-hose to transfer debris from the impeller to the bags, and that creates more drag to cut into overall performance. The Craftsman [**Photo G**], Delta 50-850, and Steel City models use 6" hose, which creates less resistance. (Our testing proved that larger-diameter duct created less resistance when compared with smaller duct.) All others use 5" hose. Still, because of variables such as fan size and shape and bags, some models with 5" hose outperformed the 6" units. We're confident those machines would perform even better with 6" hose. Five of the 5" models had extra-long hoses that resulted in near-right angles [**Photo H**] in use, restricting airflow.

■ **Foam strip helps seal leaks.** General International was the only manufacturer to include self-adhesive foam, used to line the rim where the bags mount. This proved effective at preventing dust leaks with the band clamps tightened.

Great Tip! You can do the same thing on any dust collector with inexpensive foam weatherstripping, available at home centers and hardware stores.

## Gain airflow by adding an aerodynamic hood

While testing the 15 units with straight metal duct, Jeff Hall discovered that when he cupped his hands around the open end of the duct, the air velocity increased while static pressure decreased. So we decided to compare different inlet ports in search of an advantage.

We bought a common tapered dust hood and made a custom bell-mouth hood, shown at *right*. For the latter, Jeff laminated two pieces of ¾"-thick MDF, cut a 4" hole into the center, routed one edge of the hole with a 1" round-over bit, and then glued that piece to a standard 4" plastic port. (You can also buy these in metal or plastic.)

We tested these on several collectors, and found that on one of the lower-performing units, we gained nearly 100 CFM with the plastic dust hood and nearly 140 CFM with the MDF bell-mouth hood while dropping resistance nearly 1" SP. We achieved similar results with one of the top-performing collectors. The reason for the improvement? Air (and with it, dust) changes direction easier when it encounters smooth transitions versus perpendicular corners.

### SMOOTH TRANSITION GAINS CFM

Adding either a bell-mouth hood or a tapered dust hood to any machine, such as this jointer, will increase dust removal.

Plastic or metal dust hoods and bell-mouth hoods sell for about $7–20 depending on size. (Many jointers come with a dust hood, as do some tablesaws.) But it's easy to make your own bell-mouth hood, using whatever dimensions fit your machine. If your machine has a straight port, you can remove it and replace it with a more aerodynamic hood.

| MANUFACTURER | MODEL | RATED HORSEPOWER | |
|---|---|---|---|
| CENTRAL MACHINERY | 45378-1VGA | 2 | |
| CRAFTSMAN | 21337 | 1½ | |
| DELTA | 50-760 | 1½ | |
| | 50-850 | 1½ | |
| GENERAL INTERNATIONAL | 10-105M1 | 1½ | |
| GRIZZLY | G1028Z | 1½ | |
| | G1029Z | 2 | |
| JDS | 14040 | 1½ | |
| JET | DC-1100A | 1½ | |
| PENN STATE | DC2000B | 2 | |
| | DC2V2 | 1½ | |
| RIKON | 60-200 | 2 | |
| SHOP FOX | W1666 | 2 | |
| | W1685 | 1½ | |
| STEEL CITY | 65200 | 1½ | |

1. (*) Tested at 220 volts. Units were tested at 110 volts unless prewired for 220 volts.
2. All models include a wye with two 4" ports.
3. (P) Nonporous plastic bottom bag

## You won't go wrong with either of these dust collectors

Our tests revealed three clear leaders in their ability to overcome static pressure losses while achieving high CFM: Delta's 50-760, Grizzly's G1029Z, and Penn State's DC2000B. We're naming the Grizzly and Delta as co-winners of our Top Tool award. Here's why:

The Grizzly outperformed all units by overcoming the most static pressure in 4" and 6" ducts and was second only to the Delta in maximum airflow. Its 2.5-micron top bag filters out most of the ultrafine dust, and with Grizzly making the switch to a plastic bottom bag, its overall performance should only improve. We tip our hat to Penn State for its fine-filtering bags, but its airflow performance proved slightly lower than that of the Grizzly.

But if you don't have the 220-volt hookup necessary for the Grizzly, you'll get great performance from the 110-volt Delta. It achieved the highest maximum CFM, has the easiest bag-changing system, and a superefficient 1-micron filter bag.

Grizzly G1029Z

Delta 50-760

Written by **Bob Hunter** with **Jeff Hall**
Illustrations: **Tim Cahill**

# COLLECTING THE DIRT ON DUST COLLECTORS UNDER $400

| MOTOR | | | | | | BAGS | | | | PERFORMANCE GRADES, AS EQUIPPED (5) | | | | | ACCESSORIES (6) | | | | | | | FOR MORE INFORMATION: | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VOLTAGE (1) | AMP RATING (110V/220V) | MAXIMUM AMPS PULLED IN TEST | BLOWER INLET PORT DIAMETER, INCHES (2) | BOTTOM BAG CAPACITY (CUBIC FEET) | FILTRATION SIZE, MICRONS (TOP/BOTTOM) (3) | HEIGHT WITH BAGS INFLATED (INCHES) | BAG CLAMP STYLE, TOP/BOTTOM (4) | AIRFLOW PERFORMANCE | QUALITY OF BAG FILTRATION | ABSENCE OF DUST LEAKAGE | EASE OF CHANGING BAGS | EASE OF MOBILITY | EASE OF ASSEMBLY | NOISE LEVEL, DECIBELS | STANDARD | OPTIONAL | POWER CORD LENGTH, FEET | WEIGHT, POUNDS | WARRANTY, YEARS | COUNTRY OF ASSEMBLY (7) | SELLING PRICE (8) | PHONE | WEB |
| 110 | 14/7 | 12.1 | 5 | 5.35 | 30/30 | 79 | P/P | C | D | B | A | A | C | 81 | | ALL | 6 | 100 | 90 DAYS | C | $220 | 800-423-2567 | harborfreight.com |
| 110/220 | 12/6 | 8.9 | 6 | 6.18 | 30/30 | 83 | B/C | B- | D | B | B- | B+ | A | 82 | H | B,D,M | 8 | 108 | 1 | C | 300 | 800-383-4814 | craftsman.com |
| 110/220 | 15/7.5 | 16.2 | 5 | 4.07 | 1/P | 86 | H/H | A | A | A | A | A | A | 84 | H | ALL | 8 | 100 | 2 | T | 350 | 800-223-7278 | deltaportercable.com |
| 110/220 | 12/6 | 9.1 | 6 | 5.09 | 5/P | 83 | B/C | B+ | A- | B | A- | B+ | A | 84 | H | ALL | 8 | 100 | 2 | T | 390 | | |
| 110/220 | 14/7 | 12.5 | 5 | 5.53 | 2/30 | 76 | P/P | B | B- | A | A | B+ | A | 84 | | ALL | 6 | 106 | 2 | T | 340 | 514- 326-1161 | general.ca |
| 110/220 | 18/9 | 15.7 | 6 | 5.53 | 30/30 | 76 | S/S | B | D | B | B | B- | A | 84 | | ALL | 6 | 115 | 1 | T | 240 | 800-523-4777 | grizzly.com |
| 220 | 12 | 9.8 | 6 | 5.53 | 2.5/30 | 76 | S/S | A | B- | B | B | B- | A | 84 | S | ALL | 6 | 123 | 1 | T | 260 | | |
| 110/220 | 16/8 | 14.8 | 6 | 5.53 | 1/P | 76 | P/C | B- | A | B | C | B | A | 84 | | ALL | 6 | 110 | 2 | T | 340 | 800-480-7269 | jdstools.com |
| 110/220 | 11/5.5 | 11 | 6 | 5.27 | 30/30 | 79 | B/H | B | D | A | A | B | A | 85 | | ALL | 6 | 110 | 5 | T | 330 | 800-274-6848 | jettools.com |
| 110/220* | 18/9 | 8.7 | 6 | 5.87 | 1/1 | 93 | P/P | A | A | A | A | B | B | 83 | H | ALL | 7 | 101 | 2 | C | 260 | 800-377-7297 | pennstateind.com |
| 110/220 | 18/9 | 12.4 | 6 | 5.53 | 1/1 | 76 | B/B | B | A | A | C | B- | B | 78 | H | ALL | 6 | 95 | 2 | T | 330 | | |
| 110 | 16 | 14 | 5 | 5.87 | 10/10 | 80 | P/P | B+ | C+ | B | A | B | B | 82 | | B,F,M | 6 | 104 | 2 | C | 330 | 877-884-5167 | rikontools.com |
| 220 | 12 | 8.7 | 6 | 5.87 | 30/30 | 78 | P/P | B+ | D | A | A | B | B | 84 | | B,D,H,M,R | 8 | 107 | 2 | C | 290 | 800-840-8420 | shopfox.biz |
| 110 | 16 | 13.5 | 6 | 5.53 | 30/30 | 76 | P/P | B | D | A | A | B | B | 82 | | B,D,H,M,R | 8 | 108 | 2 | C | 260 | | |
| 110/220 | 14/7 | 11.3 | 6 | 6.3 | 1/P | 83 | B/C | B+ | A | B | A- | B+ | A | 83 | H | B,D,P | 8 | 98 | 5 | T | 320 | 877-724-8665 | steelcitytoolworks.com |

4. (B) Band clamp in belt loops
(C) Band clamp with friction clips
(H) Hoop enclosed in bag rim
(P) Band clamp in continuous pocket
(S) Band clamp with cinch straps

5. A Excellent
B Good
C Fair
D Poor

6. (B) Blast gates
(D) Dust hoods
(F) Canister filter
(H) Flexible hose
(M) Finer-micron filtering bag
(P) Plastic collection bag
(R) Remote control
(S) Separator lid for trash can
(ALL) All of the above except separator

7. (C) China
(T) Taiwan

8. Prices current at time of article production and do not include shipping, where applicable.

# Pop-up Toothpick Dispenser

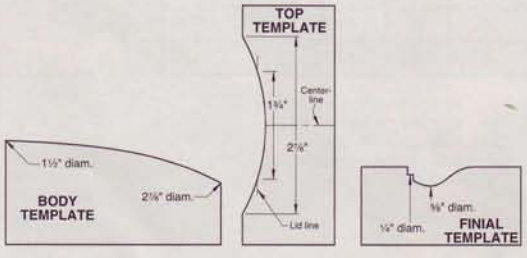
Even the humble toothpick can have an exotic holder. While turning this clever container you'll learn an ingenious technique for making a box with an inset lid.

Watch a FREE 3-part video on turning this project at woodmagazine.com/tpickvid

## 1 Gather the materials

You'll need a 3×3×6" hardwood blank for the body; a contrasting-color 1¾×1¾×4" blank for the finial and cup; a 4"-long piece of ¼" hardwood dowel for the shaft; 1¼", 1 1/16", and ¼" Forstner bits; and medium-viscosity cyanoacrylate (CA) glue. The blanks should be straight-grained, dry, and free of cracks. (We used olive for the body and walnut for the finial and cup. You can use any highly figured wood or laminate a body blank from two or more species.)

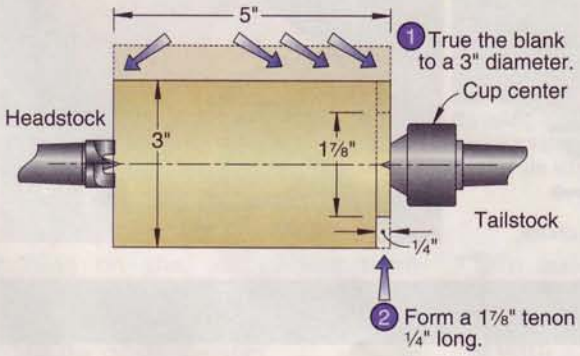
Trim the body blank to 5" long, squaring both ends. Find the centers of the ends by drawing diagonals, and mark the diagonal intersections with a center punch or awl. To make turning templates, photocopy the three **Toothpick Dispenser** patterns on the *WOOD Patterns®* insert. Adhere the pattern copies to cardboard with spray adhesive, and cut them to shape with a crafts knife.



## 2 Turn the blank into a cylinder and form a tenon

**Tools:** 1¼" spindle roughing gouge, ⅜" parting tool.
**Tool rest:** Center.
**Speed:** 1,800 rpm.

Mount the body blank between centers. Use a spindle roughing gouge to turn it into a 3" cylinder. Then use a parting tool to form a 1⅞" tenon ¼" long on the end as shown at *right*. (This end becomes the bottom of the dispenser.) Next remove the blank from the lathe and the drive center from the headstock. Install a four-jaw chuck onto the headstock spindle. Now mount the blank into the chuck by gripping the tenon with the chuck jaws.



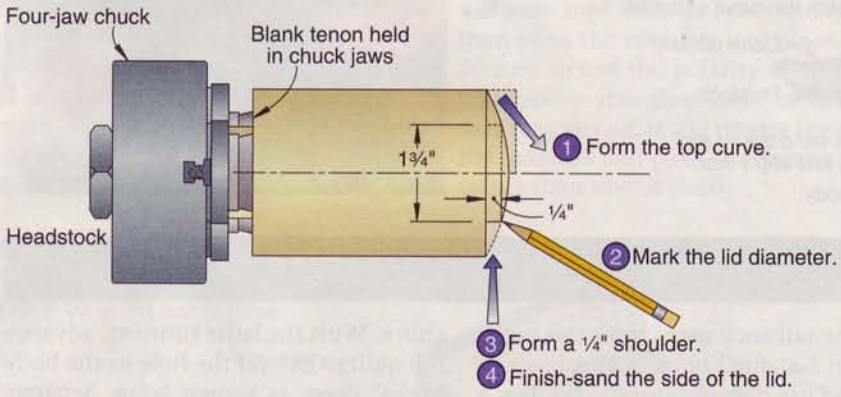

## 3 Form the lid

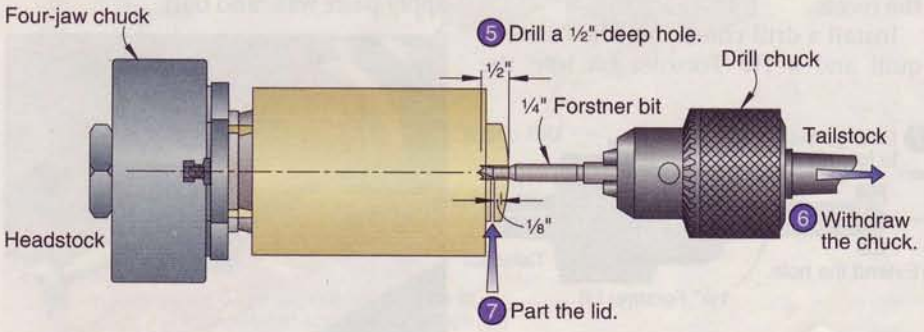
**Tools:** ⅜" spindle gouge, ⅜" and 1/16" parting tools, ¼" Forstner bit.
**Tool rest:** Spindle gouge, slightly below center; parting tools, center.
**Speed:** Turning, 1,800 rpm; drilling, 500 rpm.

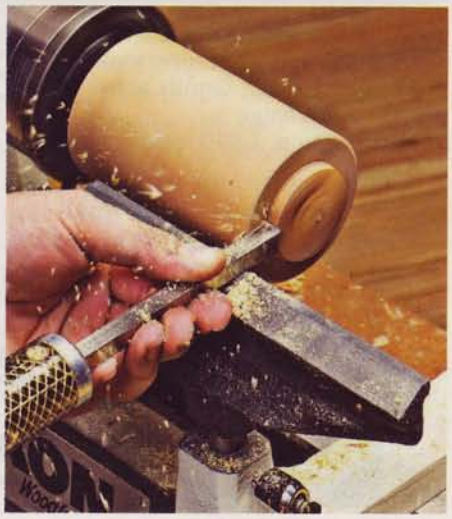
Form the top curve on the end of the blank with a spindle gouge, checking the profile with the top template. Then mark the 1¾" lid diameter on the curved surface. Now "raise" the lid with a ⅜" parting tool by cutting from the edge of the blank to the marked lid diameter, forming a ¼" shoulder as shown *below*. Finish-sand the side of the lid to 320 grit. With the lathe turning, apply paste wax to the lid side and buff with a paper towel. (We used Briwax.)

Install a drill chuck into the tailstock quill and a ¼" Forstner bit into the chuck. With the lathe running, advance the tailstock quill and drill a ½"-deep hole into the lid.

Part the lid from the blank with a 1/16" parting tool, making the lid ⅛" thick at the edge, and leaving a short stub on the remaining blank. Adhere sandpaper to a flat surface, and finish-sand the bottom of the lid. Apply paste wax to the lid bottom and buff. Avoid getting wax into the center hole.



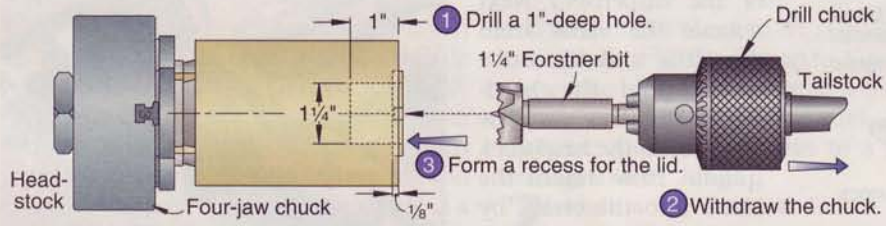



## 4 Fit the lid and finish the top

**Tools:** 1¼" Forstner bit, ⅜" square-nose scraper.
**Tool rest:** Slightly above center.
**Speed:** Drilling, 500 rpm; turning, 1,800 rpm.

Install a 1¼" Forstner bit into the drill chuck mounted in the tailstock. With the lathe running, advance the tailstock quill and drill a 1"-deep hole. Then use a square-nose scraper to form a rabbet at the edge of the hole slightly larger than the diameter of the lid and slightly deeper than the thickness of the lid edge. Use the edge of the protruding lid stub on the body blank as a guide to the proper diameter, as shown *below*. Make very small cuts with the scraper, testing the fit with the lid until it fits snugly into the recess.

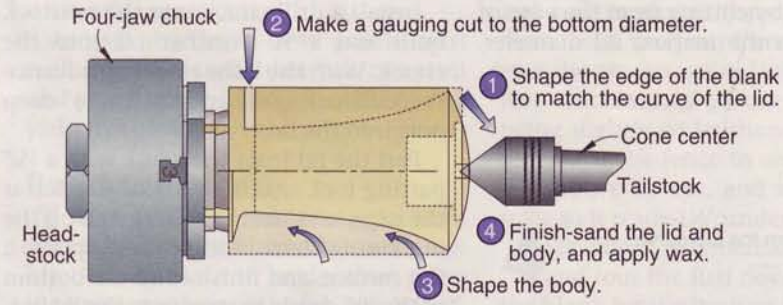


## 5 Complete the top and shape the body

**Tools:** ⅜" spindle gouge, ⅛" parting tool, 1¼" spindle roughing gouge.
**Tool rest:** Spindle gouge, slightly above center; spindle roughing gouge and parting tool, center.
**Speed:** 1,800 rpm.

Install a cone live center into the tailstock. Press the lid into the body recess, advance the cone center into the lid hole, and apply light pressure. Now, making light cuts, use a spindle gouge to shape the edge of the blank, matching the curve of the lid.

Using the body template as a guide, mark the body length. Then make a gauging cut to the bottom diameter with a parting tool. Now use a spindle roughing gouge to shape the body, as shown *below*, checking your progress with the template. Finish-sand the body and lid, apply paste wax, and buff.

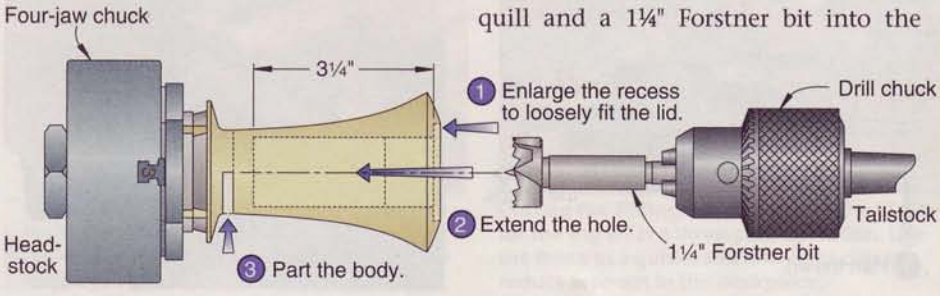


## 6 Hollow the body

**Tools:** ⅜" square-nose scraper, 1¼" Forstner bit, ⅛" parting tool.
**Tool rest:** Scraper, slightly above center; parting tool, center.
**Speed:** Turning, 1,800 rpm; drilling, 500 rpm.

Back the tailstock away from the body. Bend an L-shaped hook onto a piece of wire and use it to remove the lid. Use a square-nose scraper to enlarge the recess just enough to allow the lid to loosely fit the recess.

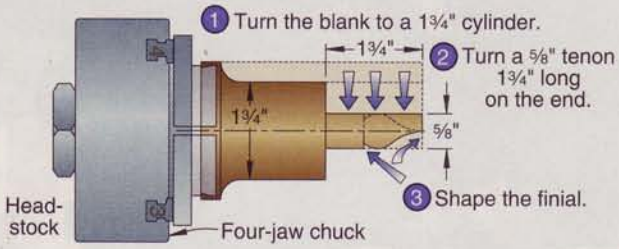
Install a drill chuck into the tailstock quill and a 1¼" Forstner bit into the chuck. With the lathe running, advance the quill to extend the hole in the body to 3¼" deep, as shown *below*. Separate the body from the waste with a parting tool. Sand the bottom of the body flat, apply paste wax, and buff.

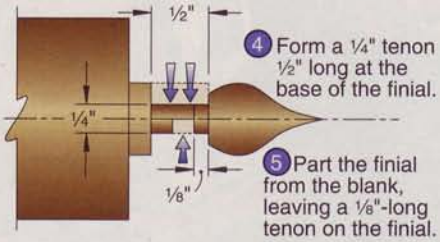


## 7 Shape the finial

**Tools:** 1¼" spindle roughing gouge, ⅛" and ⅜" parting tools, ⅜" spindle gouge.
**Tool rest:** Roughing gouge and parting tool, center; spindle gouge, slightly above center.
**Speed:** 2,500 rpm.

Mount the 1¾×1¾×4" finial and cup blank in the four-jaw chuck. Use a spindle roughing gouge to turn the blank into a 1¾" cylinder up to the chuck jaws. Then use a ⅜" parting tool to turn a ⅝" tenon 1¾" long on the end. Using the finial template as a guide, shape the finial with a spindle gouge, as shown at *left*. Now switch to a ⅜" parting tool and form a ¼"-diameter tenon ½" long at the base of the finial. Finish-sand the finial, apply paste wax, and buff. Part the finial from the blank with a ⅛" parting tool, leaving a ⅛"-long tenon on the finial.

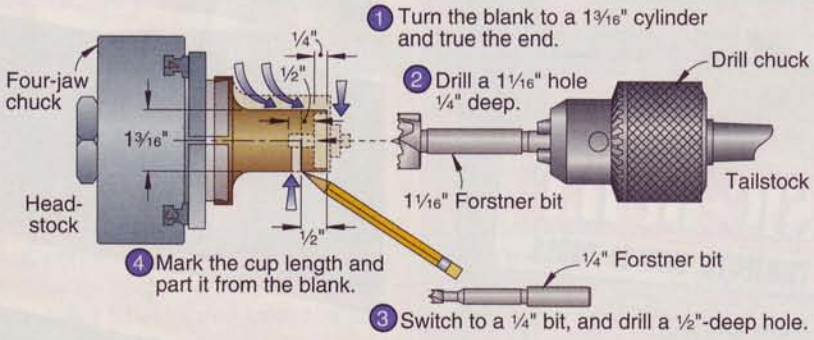



## 8 Make the cup

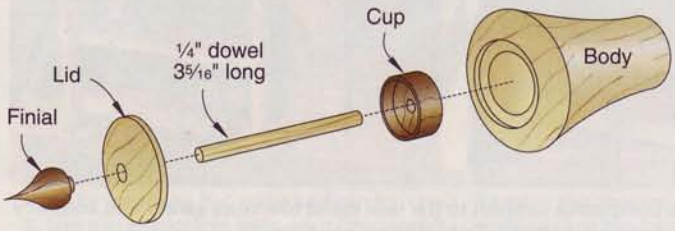
**Tools:** 1¼" spindle roughing gouge, skew chisel, 1⁵⁄₁₆" and ¼" Forstner bits, ⅛" parting tool.
**Tool rest:** Roughing gouge and parting tool, center; skew, slightly above center.
**Speed:** Turning, 2,500 rpm; drilling, 500 rpm.

Use a spindle roughing gouge to reduce the remaining cylinder to 1³⁄₁₆" in diameter. Smooth the cylinder with a skew chisel, and true the end. Install a 1⁵⁄₁₆" Forstner bit into the tailstock-mounted drill chuck, and drill a ¼"-deep hole in the end of the cylinder, as shown at *left*. Switch to a ¼" Forstner bit, and drill a ½"-deep hole centered in the 1⁵⁄₁₆" hole. Finish-sand and wax the cup, keeping the wax out of the ¼" hole. Mark the cup length, and part it from the blank.




## 9 Assemble the dispenser

Glue the finial into the ¼" lid hole with medium-viscosity cyanoacrylate (CA) glue, and let it cure. Then cut a piece of ¼" hardwood dowel 3⁵⁄₁₆" long for the shaft. Dry-fit one end of the shaft into the lid and the other end into the cup. Test the fit of the cup assembly into the body, trimming the shaft length if necessary. Remove and disassemble the cup assembly. To keep glue from leaking, adhere a piece of masking tape to the cup bottom, covering the ¼" hole. Glue the shaft into the lid and cup holes with CA glue. Reinsert the cup assembly, align the lid grain with the body grain, and let the glue cure. Remove the cup assembly and remove the masking tape. Lower the cup assembly halfway into the body, and loosely fill the dispenser with toothpicks. To close the dispenser, nest the lid into the body rabbet, aligning the grain. Dispense toothpicks by raising the cup about halfway. The toothpicks splay outward, making them easy to grasp.




Written by **Jan Svec** with **Brian Simmons**
Project design: **Brian Simmons**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

# Simple 'n' Sturdy Tool Stand

**From inexpensive 2×4s, ¾" MDF, and ¼" perforated hardboard, you can build this rock-solid workstation.**

**BASIC-BUILT™**
**GREAT PROJECTS. SIMPLE TOOLS.**

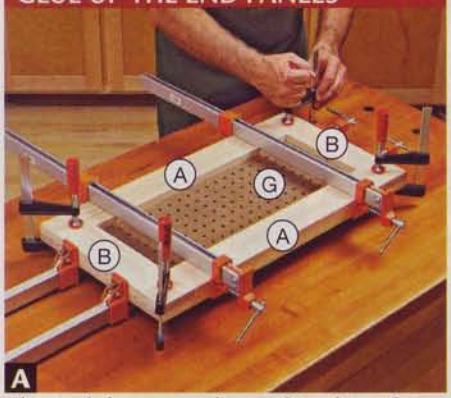
**Basic-Built projects require only a limited number of inexpensive and readily available tools and materials. For more information, go to woodmagazine.com/basicbuilt**

## PROJECT HIGHLIGHTS

- Overall dimensions: 48" wide × 18" deep × 30½" high.
- The stand easily levels to uneven floors using threaded levelers that adjust with a screwdriver.
- You'll find all of the materials and supplies needed at your local home center.

**Add this easy-to-build stock support to the tool stand to ensure safety and accuracy when machining long workpieces. To build one, see *page 24*.**

GLUE UP THE END PANELS




Glue and clamp together each end panel, using small clamps at the corners to ensure tight half-lap joints.

## Start with the panels

**1** From pine 2×4s, cut the stiles (A), end rails (B), back rails (C), feet (D), front rails (E), and cleats (F) to the sizes listed [**Materials List**, *page 79*]. For the best appearance and fit of the parts, remove the rounded corners from the 2×4s. For help with this, see the **Shop Tip**, *above right*. You can get two 1½"-square cleats from a 33"-long 2×4. To do this, rip the piece down the center. Then, cut off the rounded edge on each piece for a finished width of 1½". Set the feet aside.

**2** From ¼" perforated hardboard, cut the end panels (G) and back panel (H) to the sizes listed.

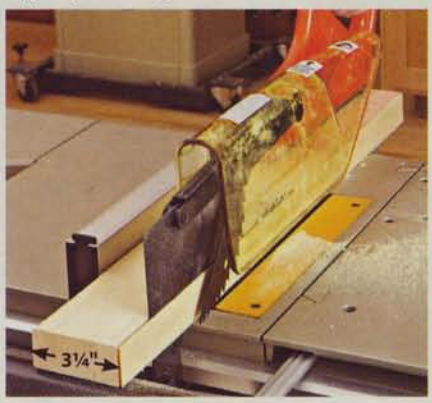
**3** Using a dado blade in your tablesaw, cut a 3" rabbet ¾" deep into each end of the stiles (A), end rails (B), and back rails (C) [**Drawings 1** and **1a**] to form half-lap joints. Or, as an alternative to a dado blade, cut the rabbets using a circular saw and router, plus an easy-to-build, two-in-one jig featured in issue 179 (October 2007), page 86, or online at woodmagazine.com/halflapjig.

**4** Measure the exact thickness of one of your ¼" perforated hardboard end panels (G). Then, using your tablesaw and a standard ⅛"-kerf blade, make two passes and cut a ¾"-deep groove, as wide as your hardboard is thick, ¾" from the *inside* face of each stile (A), end rail (B), and back rail (C) [**Drawings 1** and **1a**]. Need help? See the **Shop Tip** on the *next page*.

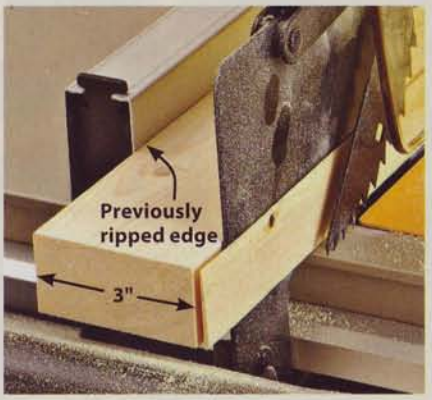
## SHOP TIP

### Square a stud in 2 easy steps

You don't need a jointer to remove the rounded corners of a 2×4. You can do it with any tablesaw. Just make sure that you start with the straightest boards you can find. For the best results, crosscut the studs to the needed lengths before ripping the edges.




**Step 1** Position your rip fence 3¼" from the *inside* of your blade. With the blade guard in place, rip one edge of the stud.



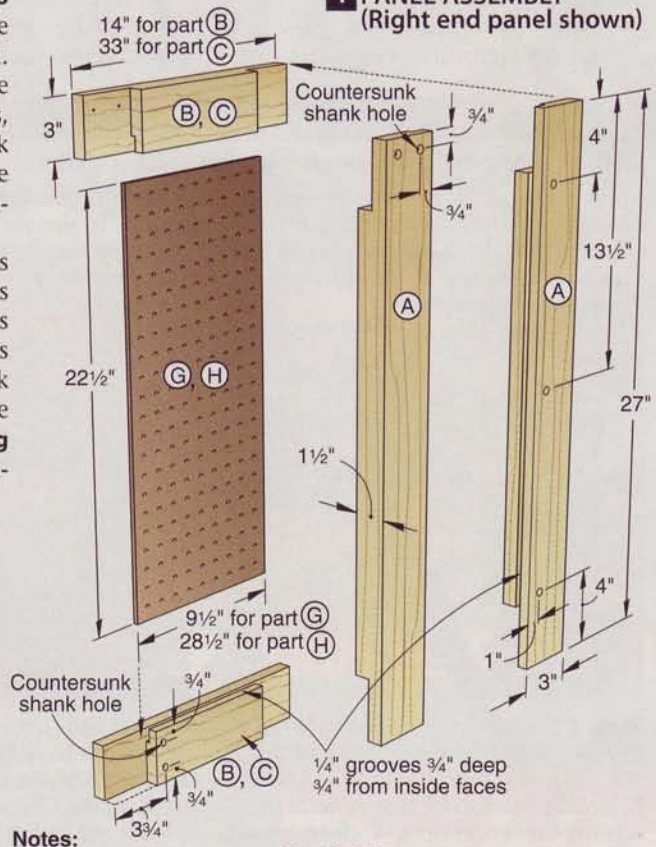

**Step 2** Reposition the fence 3" from the blade. Place the ripped edge of the stud tightly against the fence, and rip the piece again.

## Now assemble the panels

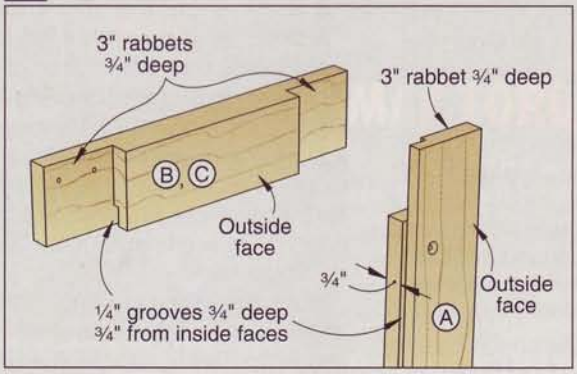
**1** Glue, assemble, and clamp together two stiles (A), two end rails (B), and an end panel (G) [**Photo A**]. Repeat to assemble the other end panel. Then assemble the remaining two stiles, back rails (C), and back panel (H) in the same way. Sand the assemblies to 150 grit.

**2** Mark centerpoints on the *outside* faces of the end-panel stiles (A) and bottom end rails (B) for the countersunk shank holes where dimensioned [**Drawing 1**]. Then, mark the centerpoints on the top front rail (E) and cleats (F), where shown [**Drawing 2**]. Drill the holes. For the #8 flathead wood screws, drill 5⁄32" shank holes. Because the pine is soft, you don't need to drill pilot holes.

**1** PANEL ASSEMBLY
(Right end panel shown)



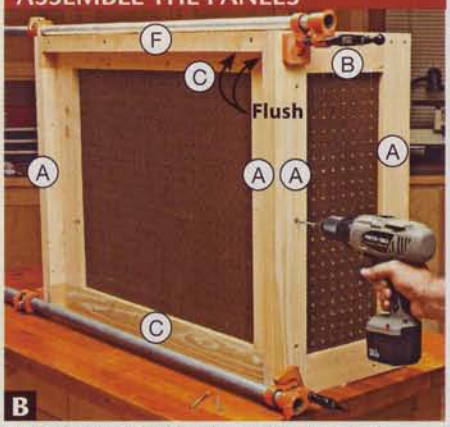

**1a** RABBET AND GROOVE DETAIL




**Notes:**

1. Left end-panel assembly Ⓐ/Ⓑ/Ⓖ is a mirror image.
2. The back-panel assembly Ⓐ/Ⓒ/Ⓗ does not have screws (no mounting holes needed).
3. Size groove width to match thickness of perforated hardboard.

ASSEMBLE THE PANELS

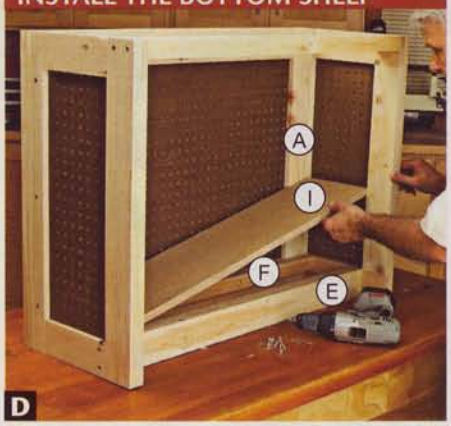



With the end and back panels clamped together, drive the screws into the predrilled holes in the end-panel back stiles (A).

RIP THE MDF PARTS

Use a helper (or support stand) to ensure safety when ripping the 24×48" MDF panels for the shelves (I, J) and top (K) to size.

INSTALL THE BOTTOM SHELF




Angle the bottom shelf (I) into the tool stand, and seat it on the bottom cleat (F) and front rail (E), tight against the back stiles (A).

**3** With the countersunk shank holes in the correct orientation, glue and screw a cleat (F) to the *inside* face of the back panel, flush with the top edge of the bottom back rail (C). Then, glue and screw the remaining cleat to the *outside* face of the top back rail, flush with the *top* edge.

**4** Assemble and clamp together the end panels (A/B/G) and back panel (A/C/F/H), with the *outside* face of the top cleat (F) flush with the *back* edges of the end-panel stiles (A). Drive the screws [**Photo B**].

**5** Clamp the top front rail (E), which has the predrilled mounting holes for attaching the top (K), into position between the end panels [**Drawing 2**]. Drive the screws. Repeat to mount the bottom front rail, where shown.

## Add the shelves and top

**1** From ¾" MDF, cut the bottom shelf (I) and adjustable shelf (J) to the sizes listed. Then cut two 18×48" pieces to form the laminated top (K) [**Photo C**]. For ease of handling, cut the parts from 24×48" pieces instead of 48×96" sheets, which are heavy and awkward.

**2** From a pine 2×4, cut the adjustable-shelf cleats (L) and supports (M) to the sizes listed.

**3** Drill the countersunk mounting holes into the bottom shelf (I) [**Drawing 2**]. Then, position the shelf into the tool stand [**Photo D**], and drive the screws.

**4** Glue and screw the adjustable-shelf cleats (L) to the shelf (J), flush with the front and back edges and centered end to end. Set the shelf aside.

**5** To form the top (K), align and clamp the two 18×48" MDF pieces together. Drill the countersunk holes, where shown [**Drawing 2**, **Photo E**]. For consistent hole depths, wrap a piece of masking tape around the bit for a visual depth stop. Separate the pieces, and apply glue to the mating faces using a roller. Next, realign the pieces, clamp them together, and drive the screws. After the glue dries, scrape off the squeeze-out. Then rout ⅛" round-overs along the top and bottom edges and ends of the top.

**6** Position the top (K) with the bottom face (screw side) up. Then, center the tool stand, with the top end down, front-to-back and side-to-side on the top. Using the shank holes in the top front rail (E) and cleat (F) as guides, drill pilot holes into the top. Drive the screws. Leave the stand in this position.

## Wrap it up

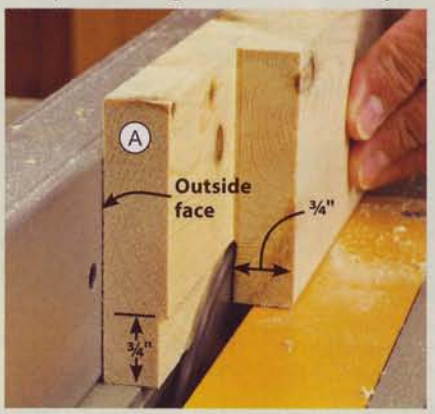
**1** Retrieve the feet (D). Drill the ½" holes ½" deep with a ⅜" hole centered inside into the bottom of the feet, where dimensioned [**Drawing 2**]. Next, drill the countersunk mounting holes into the bottoms for attaching the feet to the stand. Install the ⅜" T-nuts and ⅜×2½" levelers into the counterbored holes. Now screw-mount the feet to the stand [**Photo F**].

**2** Set the stand upright. Then, position the adjustable-shelf supports (M) where desired. Using the ¼" holes in

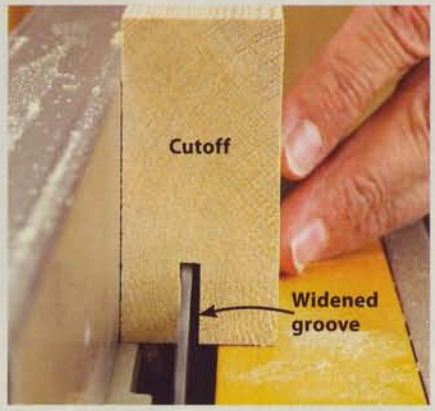
## SHOP TIP

### Cut a snug-fitting panel groove in 2 steps

Think that your ¼" perforated hardboard panels measure the specified thickness? Chances are they measure about 3/16", as ours did. To size the grooves in the stiles (A), end rails (B), and back rails (C) to snugly fit the panels, cut the grooves in two passes using a ⅛"-kerf blade in your tablesaw. Here's how.




**Step 1** Position your rip fence to cut a groove ¾" from the *inside* face of the stiles (A), end rails (B), and back rails (C). With the *outside* face of each part against the fence, rip a ¾"-deep groove along an edge. Cut another groove in a 1½×3" cutoff about 12" long.



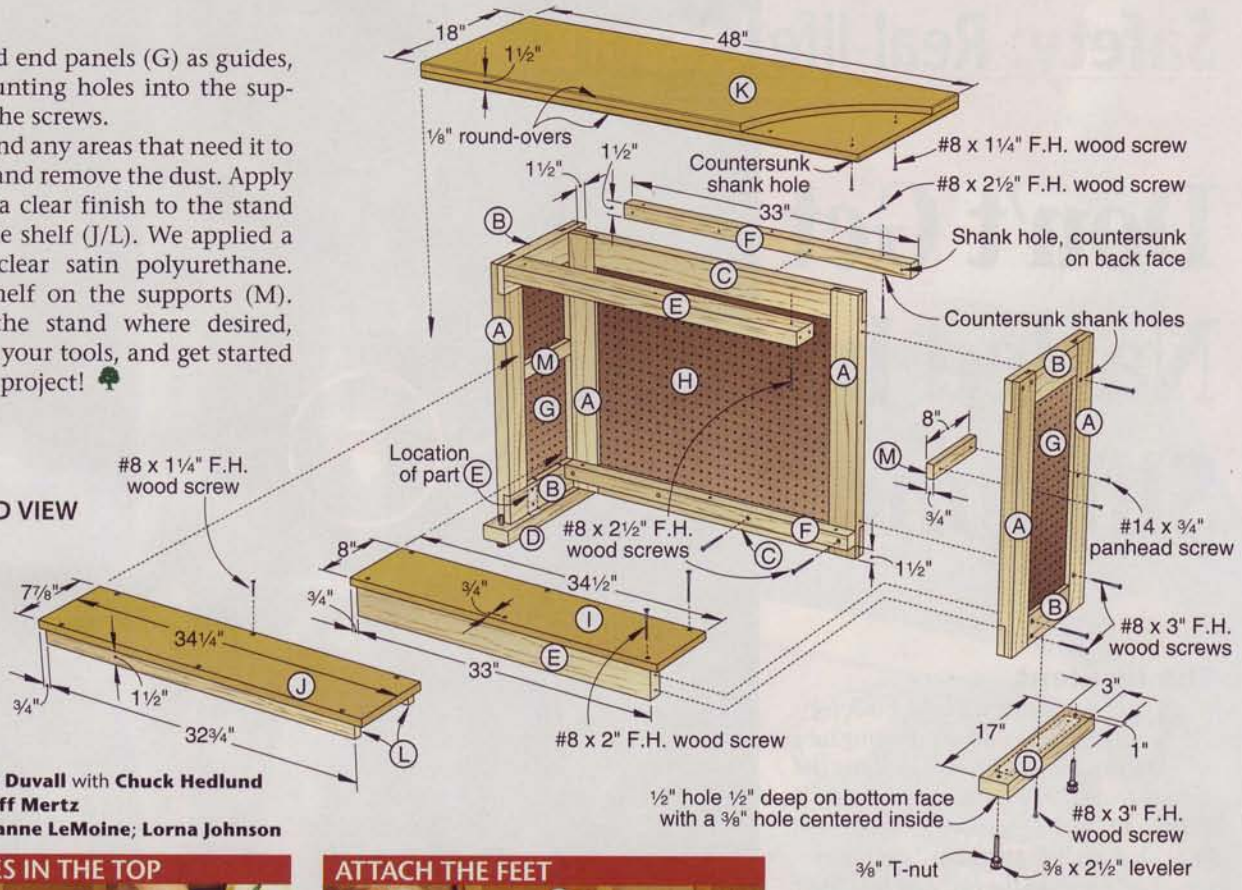

**Step 2** Shift the fence toward the blade as needed to widen the groove. With the same face of the cutoff against the fence, rip it again. Check for a snug fit of the hardboard. Adjust the fence if needed, and cut again. Then widen the groove in the parts.

the perforated end panels (G) as guides, drill the mounting holes into the supports. Drive the screws.

**3** Finish-sand any areas that need it to 150 grit, and remove the dust. Apply two coats of a clear finish to the stand and adjustable shelf (J/L). We applied a water-based clear satin polyurethane. Install the shelf on the supports (M). Now place the stand where desired, equip it with your tools, and get started on your next project!

Written by **Owen Duvall** with **Chuck Hedlund**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine**; **Lorna Johnson**

## 2 EXPLODED VIEW




### DRILL HOLES IN THE TOP

**Clamp the two MDF pieces for the top (K) together with the edges and ends aligned. Drill the countersunk holes.**

### ATTACH THE FEET

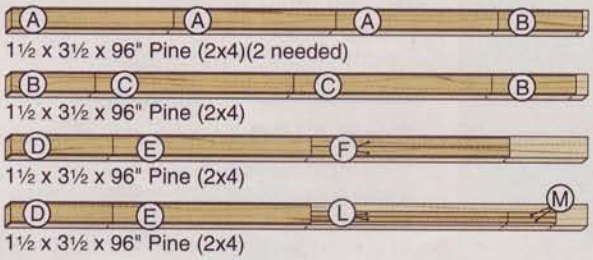
**Center the feet (D) on the bottoms of the end panels. Drive the screws through the feet and into the panels.**

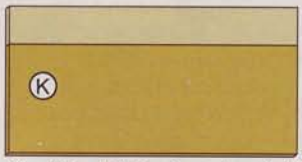
## Materials List

| Part | | FINISHED SIZE T | W | L | Matl. | Qty. |
|---|---|---|---|---|---|---|
| A | stiles | 1½" | 3" | 27" | P | 6 |
| B | end rails | 1½" | 3" | 14" | P | 4 |
| C | back rails | 1½" | 3" | 33" | P | 2 |
| D | feet | 1½" | 3" | 17" | P | 2 |
| E | front rails | 1½" | 3" | 33" | P | 2 |
| F | cleats | 1½" | 1½" | 33" | P | 2 |
| G | end panels | ¼" | 9½" | 22½" | PH | 2 |
| H | back panel | ¼" | 28½" | 22½" | PH | 1 |
| I | bottom shelf | ¾" | 8" | 34½" | MDF | 1 |
| J | adjustable shelf | ¾" | 7⅞" | 34¼" | MDF | 1 |
| K | top | 1½" | 18" | 48" | LMDF | 1 |
| L | adjustable-shelf cleats | ¾" | 1½" | 32¾" | P | 2 |
| M | adjustable-shelf supports | ¾" | 1½" | 8" | P | 2 |

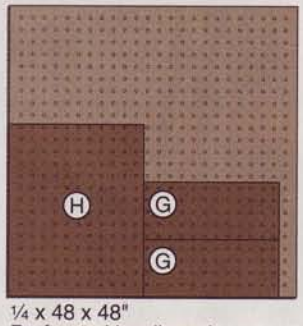
**Materials key:** P–pine, PH–perforated hardboard, MDF–medium-density fiberboard, LMDF–laminated medium-density fiberboard.
**Supplies:** #8x1¼", #8x2", #8x2½", #8x3" flathead wood screws; ⅜" T-nuts (4); ⅜x2½" levelers (4); #14x¾" panhead screws (4).
**Blade and bit:** Dado-blade set, ⅛" round-over router bit.

## Cutting Diagram

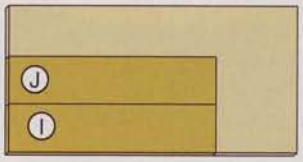



¾ x 24 x 48" Medium-density fiberboard (2 needed)




¼ x 48 x 48"
Perforated hardboard




¾ x 24 x 48" Medium-density fiberboard

# Don't Get Nailed by Shrapnel

## The incident

*As I was ripping a 2"-thick oak leg salvaged from an old drafting table, I struck a hidden nail, causing the carbide-tooth blade to chatter as it cut through the metal. I paused for a moment, thinking everything was okay, and then proceeded to finish the cut. BIG MISTAKE!*

*A carbide blade tooth suddenly broke loose and struck my right index finger. This caused a small but jagged cut that, to my relief, bled and hurt little. I cleaned and bandaged the cut. By the next morning, my finger was swollen and stiff. So I went to my doctor, who ordered an X-ray.*

*To our astonishment, the image, shown* above right, *revealed that the carbide tooth had penetrated my finger and lodged against a bone. This required surgical removal of the piece and stitching of a nicked tendon. Thankfully, my finger healed without any permanent damage.*

*—George Shea, North Haven, Conn.*

## The woodworker

George works for an advertising/marketing agency. An intermediate-level woodworker, he builds furniture and other home projects.

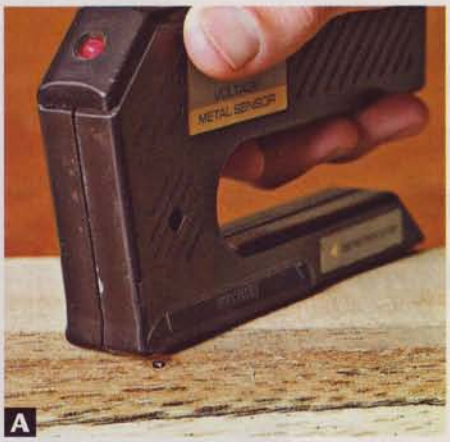
## The warning signs

Trying to be a thrifty woodworker, George cut the salvaged wood without first checking it for hidden metal objects. Although all of the hardware was removed, he did not consider the possibility that the leg might contain a broken nail or other piece of metal.

## The lessons

Here are some things you can do to prevent such an incident.

- Visually inspect *every* board—old or new—for metal objects, including staples. Deeply embedded objects can be hard to detect, but stains or tiny openings may clue you in to entry points for nails or screws.
- Use a strong magnet, such as a rare-earth type, or a metal detector [**Photo A**] to check the board for ferrous metal.




**A**

**An LED on this metal detector illuminates as it finds a nail embedded into this tiny opening along the edge of a piece of 5/4 oak.**

(You can find metal detectors at woodworking supply stores for as little as $18. Some stud finders also detect metal.) Scan the board slowly and methodically, using a zigzag motion and overlapping the passes. Scan both faces and along the edges and ends.

- Should you strike a metal object during a cut, immediately shut off the saw. Remove the blade, and have it inspected by a professional sharpening service or the manufacturer for possible damage.
- Always use your saw's blade guard, and wear safety glasses.
- Never stand or position your hands directly in line with the blade.

## Earn $100 for your story

**Help other readers work safely by sharing a personal shop-related mishap or near miss. Send a detailed description of the incident (about 150 words) along with photos or illustrations and a daytime phone number to: Safety: Real Life Lessons, WOOD magazine, 1716 Locust St., LS-221, Des Moines, IA 50309-3023. Or e-mail us at safety@woodmagazine.com**

Scrapwood Project

# Rippling Ribbon Clock

**Build this whimsical eye-pleaser from leftover veneer.**

## Fashion the form first

1 From 1½"-thick hardwood (we used hard maple; softwoods might not prove strong enough to form the ripples in the veneer) cut a 3×7" blank.

2 Make a copy of the full-size form pattern from the *WOOD Patterns*® insert on *page 53*. Attach it to one edge and end of the blank with spray adhesive, wrapping it around the blank at the dotted line.

3 Using a ¼" or smaller blade on your bandsaw, cut away the waste portion of the blank. Sand both faces smooth with your spindle sander or a drill-press sanding drum.

4 Cover both inside faces of the form with clear packing tape to prevent the glued-up veneer from sticking to the form.

## Make the clock body

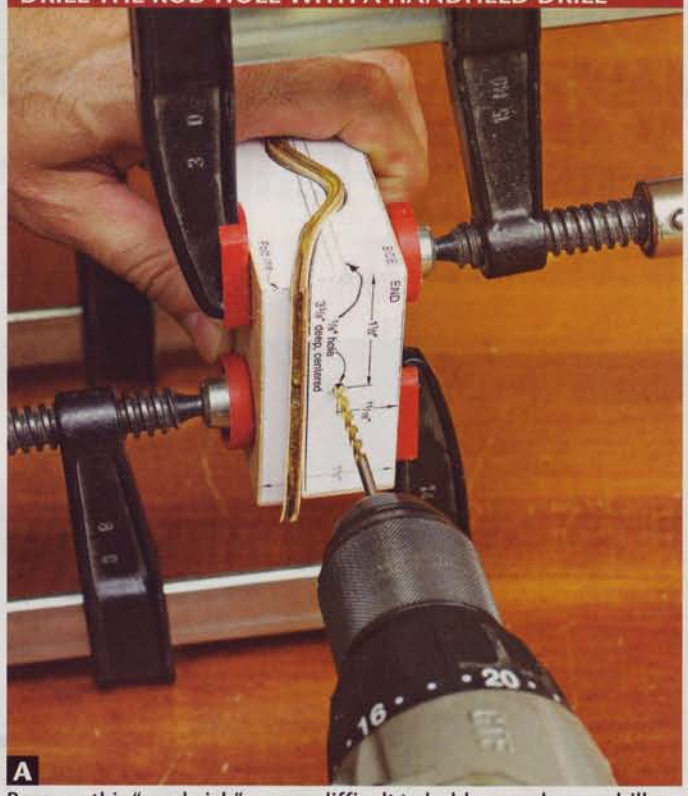
1 Cut six pieces of veneer 3½×8½" with the grain running the long dimension. (We used bird's-eye maple for the face, on top of five alternating plies of walnut and mahogany.)

2 Dampen the veneer with warm tap water (to make it pliable and prevent splintering) until all surfaces are covered. Do not soak them. Stack them in the order you want for the finished clock—with the face veneer oriented as indicated on the form pattern—and then place them between the form sections.

3 Gradually tighten clamps along the length of the form, stopping when the form sections have pulled together. It's okay if some portions have slight gaps. Leave clamped overnight.

*continued on page 84*

DRILL THE ROD HOLE WITH A HANDHELD DRILL



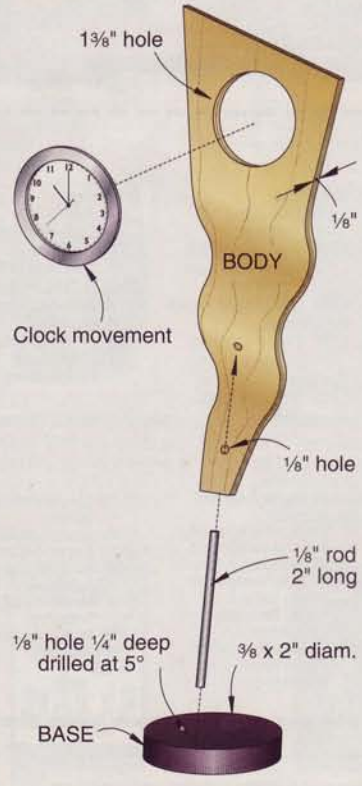
A

Because this "sandwich" proves difficult to hold squarely on a drill press, use a cordless or electric drill instead.

BANDSAW THE CLOCK BODY TO SHAPE

B

Cut to within 1/32" of the pattern lines on the bandsaw, and then sand the edges smooth.




EXPLODED VIEW

**4** Remove the veneer pieces from the clamps and lay them out to air-dry—an hour or two should do it. Keep the veneers in the same order so they'll glue together tightly.

**5** When they're dry, apply a thin, even coat of yellow wood glue to the mating veneer surfaces. Sandwich them together in the form and clamp tightly. Allow the glue to dry overnight. (Don't worry if the outer edges of the veneer gap slightly; you'll trim away the outer edges later.)

**6** Before removing the clamps, drill a ⅛" hole 2⅜" deep into the end of the form-and-veneer sandwich [**Photo A**], where shown on the pattern. Remove the veneer blank from the form.

**7** Make a copy of the full-size clock body pattern, and adhere it with spray adhesive to the front face of the veneer blank. Center the pattern on the ⅛" hole.

**8** Drill a 1⅜" hole for the clock insert, where shown on the pattern.

**9** Cut the body to shape on the bandsaw [**Photo B**].

## Now finish the job

**1** Cut a 2"-diameter disc from ⅜" stock, and sand it smooth. We used poplar, and then painted it black.

**2** Drill a ⅛" hole ¼" deep at a 5° bevel into the base ½" from the edge.

**3** Apply three coats of satin spray lacquer to the clock body, sanding lightly between coats with 400-grit sandpaper.

**4** Install the stainless-steel rod into the base hole with epoxy. Slide the clock body onto the rod, adhering it to the rod with epoxy.

**5** Press the clock movement into the 1⅜" hole.

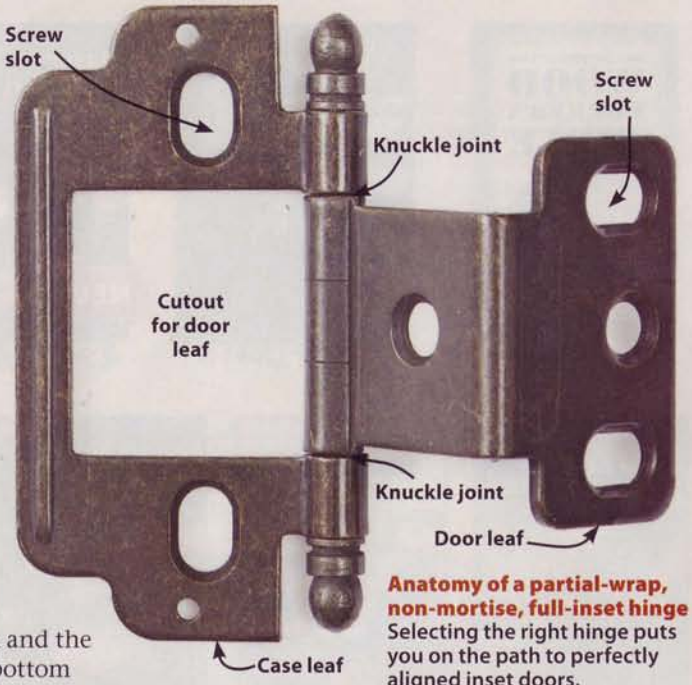
Project design: **Schlabaugh & Sons**

## Source

**Clock and stainless rod:** One clock: part #RC-1, $7.50; five clocks: part #RC-5, $32.50; (add $4.95 for shipping), Schlabaugh & Sons, 800-346-9663 or online at schsons.com.
**Veneer:** Assorted pack for one clock: part #LP-RC-1, $3.50; assorted pack for five clocks: part #LP-RC-5, $15.50, (add $4.95 for shipping), Schlabaugh & Sons, above.

# Installing Inset Doors

The right hardware combined with foolproof marking guarantees perfection.




**Anatomy of a partial-wrap, non-mortise, full-inset hinge**
Selecting the right hinge puts you on the path to perfectly aligned inset doors.

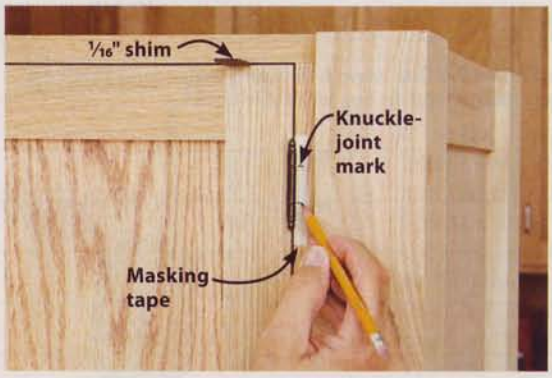
Inset cabinet doors, like those on the hutch on *page 38*, can be an acid test of your woodworking skills because with no overlay to hide a less-than-perfect hanging job, any misalignment shows. Fortunately the job isn't as hard as it looks. Here's how.

First choose the right hardware. For the hutch project we selected partial-wrap, non-mortise, full-inset hinges, shown *above right*. These widely available hinges make it easy to inset a ¾"-thick door. The non-mortise feature leaves a 1/16" gap between the door hinge stile and the case, and the screw slots allow for fine-tuning of the door position after installation.

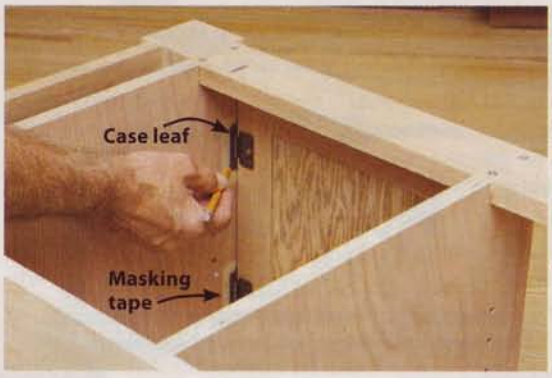
To begin, mark the location of each hinge on the door. (For the hutch, mark lines 2" from the top and bottom of each hinge stile. Align the top edge of the top case leaf with the upper mark and the bottom edge of the bottom case leaf with the lower mark.) Drill pilot holes centered in the slots, and screw the hinges in place. Then test-fit the doors in the openings. You should see an equal 1/16" gap on all four sides between the door and the case. If not, trim the door edges where necessary. To make sure you reinstall each door in the opening for which it was fitted, mark the location (left, center, right) on the bottom edge of the bottom rail.

Apply 2"-wide masking tape to the case at the hinge locations with ½" of the tape width on the front edge of the case and the remainder wrapped around the corner onto the inside face. Now, to accurately position the hinges on the case, follow the four steps shown in the photos.

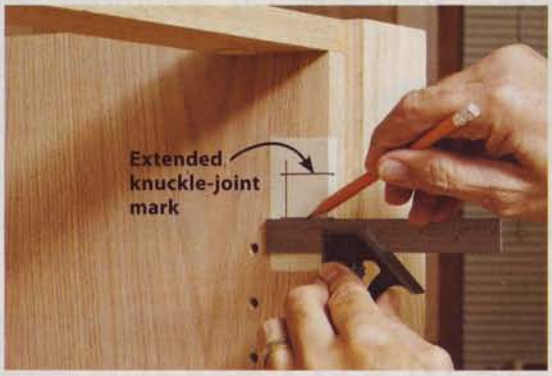
With all the screw holes drilled, remove the hinges and tape, and apply finish to the project. After the finish dries, install the doors, centering the screws in the slots. Check the alignment of each door and, if necessary, make adjustments. The hinge case-leaf slots allow up-and-down adjustment, and the door-leaf slots allow right-to-left adjustment.



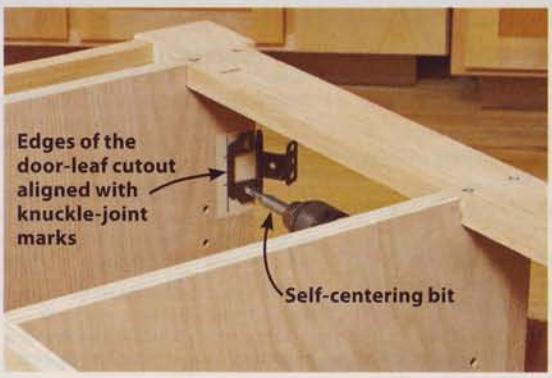

**Step 1**
Center the door in the opening with 1/16" shims. Mark the joints between the hinge knuckles on the tape.




**Step 2**
Reaching inside the cabinet from the top, trace the back edge of each hinge case leaf onto the tape.




**Step 3**
Remove the door and extend the knuckle-joint marks onto the tape on the inside face of the case member.




**Step 4**
Adhere a hinge to the case with double-faced tape, aligning it with the marks. Drill pilot holes centered in the slots.

# Ask WOOD

Answers to your questions from letters, e-mails, and WOOD Online®

## HAVE A QUESTION?

For an answer to your woodworking question, write to **ASK WOOD, 1716 Locust St., LS-221, Des Moines, IA 50309-3023** or e-mail us at **askwood@woodmagazine.com**. For immediate feedback from your fellow woodworkers, post your questions on one of our woodworking forums at **woodmagazine.com/forums**.

## Here's a recipe for black oak

**Q: Years ago, I knew of a vinegar solution that blackens oak. I remember the vinegar part, but what else goes with it?**

*—Scott Swager, Jolon, Calif.*

**A:** Add a little iron and now you're cookin', Scott. Iron mixed with white vinegar produces a centuries-old finish, called "iron buff," that can be brushed onto oak, and most other woods, to darken their color.

To make iron buff, rinse a pad of steel wool with lacquer thinner to remove the protective oil. Allow the pad to dry. Then tear the pad into pieces and soak them in a pint of vinegar until the acid begins to dissolve the steel. Soak the pad overnight for a light color change or for a week to achieve darker colors. When a dab of iron buff turns a test board the desired color, strain the solution through a tightly-woven cloth, such as an old t-shirt, to remove the largest pieces of undissolved iron. Then strain it again through a coffee filter to remove the remaining particles.

The vinegar itself doesn't change to a dark color that dyes the wood. Instead, the iron in the vinegar reacts with chemicals in the wood, causing them to change color. Because it's a chemical process instead of a wiped-on stain or dye, you get blotch-free color. Each batch will vary, though, so mix enough to stain an entire project. Apply an optional oil-based stain to deepen the gray or black color for a darker tone. Then apply a film finish.

*continued on page 92*



PRECISION MILLED TEETH | INDUCTION HARDENED
FLEXBACK CONSTRUCTION | MATCH TOOTH WELDED

"STAYS SHARP MUCH, MUCH LONGER."

carter classic bandsaw upgrades

AccuRight™ Bandsaw Blades

A new standard for precision and durability.

From the company that has been making bandsaws better for over 75 years.

Buy three bandsaw blades.
Get FREE "Bandsaw Tuning" DVD.
($14.95 Value)

carter products

Circle No. 176

www.carterproducts.com | Toll-Free 888.622.7837

Your Vision. Your Creativity.
Your Business excels with an

Epilog Laser System.

**The Epilog Difference**
From laser engraving and cutting basic logos and text to the most intricate and sophisticated designs, Epilog laser engraving systems allow you to customize all of your wood products quickly and easily.

**Get Creative with an Epilog Laser**
From engraving and cutting custom plaques to wood puzzles to pens, our laser systems provide a wide variety of additional capabilities and service to your business.

Systems starting at $9,995!

20 Years in 08

**Contact us NOW to receive your free informational kit which includes:**

- Epilog's Full Brochure
- A CD Demo featuring our machines in action
- Engraved and cut samples
- A laser engraving wood workers guide.

EPILOG LASER

Epilog Laser • 1.888.437.4564 • sales@epiloglaser.com
www.epiloglaser.com/bhg.htm

Circle No. 1515

10% OFF CLAMPS
SUPER CLAMP SALE
Use Code WCLAMP08 When You Order
To Save An Additional 10% Off Advertised Clamp Prices
10% OFF CLAMPS
To Purchase from our large selection of products log onto www.woodline.com or Call 800-472-6950 Today

WOODLINE USA PARALLEL CLAMP SYSTEM
NEW
• True Parallel Heads provide reliable uniform pressure across the full length of the clamp surface
• Durable Tool Steel Rail for years of reliable service
• Built In Clamp Pad eliminates damage to materials
• Reversible head for push/pull action
• Built in flip-down clamp stand stabalizes for multiple clamp applications
Folding Handle System For Superior Clamping Pressure Without The Strain
PC-15 - 15" Capacity.....$25.95
PC-27 - 27" Capacity.....$27.95
PC-39 - 39" Capacity.....$32.95
PC-59 - 59" Capacity.....$35.95

66 Pc
Master Wood Working Router Bit Set
Woodline USA's most comprehensive carbide tipped bit collection features 66 carefully chosen profiles in a fully labeled wooden case. The perfect set to start or complete every woodworkers collection of bits.
ONLY $189.95
WL-2066 : 1/2" Shank
WL-2065 : 1/4" Shank

6pc Cabinet Set
▪ 3-1/4" ogee raised panel
▪ 2-piece ogee rail & stile
▪ reversible glue joint
▪ drawer lock
▪ door lip
ONLY $119.95
WL-2020-1 : 1/2" Shank

8Pc Picture Frame Bit Set
FREE STRAP CLAMP
Perfect for making great looking picture frames. Bits can be combined to form complex mouldings or simple decorative frames.
ONLY $75.95 FREE MOULDING BOOK ON CD
WL-2008 : 1/2" Shank
WL-2007 : 1/4" Shank

5Pc Moulding Bit Set
FREE MOULDING BOOK ON CD
The perfect set for all woodworkers with 5 popular profiles that can be matched together for unlimited options!
ONLY $94.95
WL-2011 : 1/2" Shank

Woodline USA - 111 Wheeler St., LaVergne, TN 37086 - 800-472-6950 - 615-793-0474 - www.woodline.com
WOODLINE.COM
WOODLINE USA
Circle No. 310

# Ask WOOD

## Specific gravity: a weighty subject

**Q: I've heard people refer to a wood's specific gravity. What are they talking about? Is it important when I'm choosing wood for a project?**

*—Kerry Johnson, St. Louis, Mo.*

**A:** Specific gravity tells you how much the wood's cell structure contributes to its density, Kerry. It's the ratio between the density of a piece of wood after it's oven-dried and the density of enough water to equal the wood's volume. That volume for the second measurement varies with wood's moisture content, so before you can compare different wood species, a specific-gravity chart like the one *below* needs to tell you whether the wood was tested when green, dried to 12 percent moisture content, or oven-dry.

Specific gravity matters because woods with high specific gravities tend to swell and shrink more across their grain than those with lower specific gravities. That can be hard on painted finishes for outdoor projects, for example. So for these applications, look for woods with low specific gravity, such as cedar or redwood.

Not all woods have a specific gravity less than 1. Lignumvitae's specific gravity of 1.05 (oven-dry weight to green volume) means it's heavier than water and sinks. Such density makes it good for mallets and other tools.

| Wood Species | SG Green | SG 12% |
|---|---|---|
| Ash (White) | .55 | .60 |
| Birch (Yellow) | .55 | .62 |
| Cedar (Western Red) | .31 | .32 |
| Cherry | .47 | .50 |
| Hickory (Shagbark) | .64 | .72 |
| Maple (Silver/Soft) | .44 | .47 |
| Maple (Sugar/Hard) | .56 | .63 |
| Oak (Northern Red) | .56 | .63 |
| Oak (White) | .60 | .68 |
| Pine (Western White) | .36 | .38 |
| Poplar | .40 | .42 |
| Redwood (Young) | .34 | .35 |
| Sweetgum | .46 | .52 |
| Walnut | .51 | .55 |

*continued on page 94*

Circle No. 1301
Warm to the comfort of radiant heat
RADIANT
Floor Company
Efficient, Quiet, Reliable
It's never been easier to do it yourself
compatible with any fuel source:
GAS, PROPANE
SOLAR, OIL, WOOD
ELECTRIC,
GEOTHERMAL
VISIT OUR WEBSITE
CALL FOR A FREE QUOTE
www.radiantcompany.com
Barton, Vermont
(toll free) 1.866.WARM-TOES (927.6863)

It's So Easy, I Just Open The Door And Step In!
Walk-In Bath Tubs from Premier
Walk-In Bathtubs By Premier. As we get older bathing can become more of a challenge. Premier has an extensive range of walk-in tubs which have helped improve the lives of thousands of people. Call today or return the coupon and discover which one of our superb walk-in tubs could benefit you the most.
Please send me a FREE Premier Brochure of Walk-in Tubs
Premier Care in Bathing
Name
Telephone
Address
City
State Zip
Send to: Premier Bathrooms Inc, 2330 South Nova Rd, South Daytona, Florida 32119
CODE 178018
CALL NOW • TOLL FREE
1-800-578-2899
SOURCE CODE 178018

# Ask WOOD

## Cabinets should store wine on its side

**Q: I'm designing a wine cabinet that when closed looks like a steamer trunk. But I don't know the best angle for storing wine bottles. Also, what else does such a cabinet normally hold?**

*—Bill Prange, Canyon Country, Calif.*

**A:** So long as the bottle angle keeps the cork moist, you're storing it safely, Bill. Beyond that, just keep it away from heat and direct sunlight.

As for accessories, a drawer to hold a corkscrew and towels would be handy. If your design allows, include racks or storage space for wine glasses, as we did with the wine cabinet in issue 172 (October 2006), shown *below*. For plans and instructions to make this cabinet, go to woodmagazine.com/winecabinet

# Shop-Proven Products

These woodworking wares passed our shop trials.

**About our product tests**

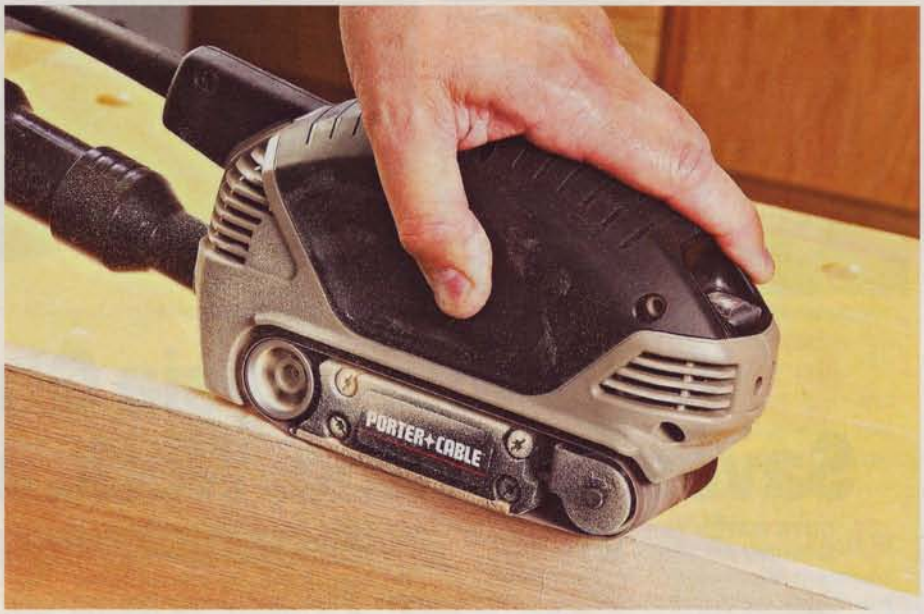
We test hundreds of tools and accessories, but only those that earn at least three stars for performance make the final cut and appear in this section.

## Compact belt sander delivers big performance

Some purists consider a belt sander a crude woodworking tool, capable of hogging away material in a hurry, but not good enough for fine work. That's because belt sanders usually weigh 12 lbs. or more and prove cumbersome. Porter-Cable's 371K compact belt sander has broken those barriers and earned a place in my shop.

This tool is not like any belt sander I've used. First of all, it weighs only 5 lbs. Second, its compact body, full-length rubber-grip back, and removable front handle make it easy to maneuver—even with one hand—into tight places and overhead without my arms getting weary. And third, the dust collection proves surprisingly effective when hooked up to my shop vacuum.

I began using the 371K to sand planer snipe and scallop marks from 700 linear feet of 3"-wide trim I milled for my house. It would take a random-orbit sander a week to do that job, but I did it in just a few hours with this dandy and didn't feel like I'd just wrestled a hog. The 371K proved invaluable as I used it to scribe the back edges of laminate countertops—with excellent one-handed control—to match my kitchen walls. I'd struggle to get that kind of fit with a big belt sander.




After using the sander for extended uses it got a little hot—as I'd expect with any power tool—but the rubber grip insulated my hand from the heat. The 371K comes with one 80-grit, 2½"×14" belt. I recommend getting some finer grits as well because I was able to sand an edge-joined coffee table top smoother than I expected (180 grit), saving me a few steps with my finish sander. A five-pack of belts costs $10 at Woodcraft (800-225-1153 or woodcraft.com).

*—Tested by Kevin Boyle*

**Compact Belt Sander, model 371K**

| | |
|---|---|
| Performance | ★★★★★ |
| Price | $120 |

Porter-Cable
888-848-5175; deltaportercable.com

## The sky, er, ceiling's the limit with these stackable panel clamps

It's like when someone first figured out the solution to overcrowded parking in a city: Go vertical. That's what the makers of R&R Clamp have done with their unique stackable clamps. With space always at a premium in home and professional workshops, this clamping system allows you to glue up and clamp multiple assemblies by stacking them like floors of a parking garage.

Here's how the system works: First, you screw two alignment bars to a plywood base, making sure to keep them parallel to each other. Then, when you attach two clamps onto these bars (at any of the multiple mounting slots), they're dead-on square every time. Glue up your workpieces, place them between the jaw clamps, and then tighten using your drill and a ¾" socket and adapter (included). To stack clamps simply place them on top of each other as you align the interlocking position pins.

Besides being able to clamp up more assemblies in a limited benchtop space, I found that by the time I got six panels glued and stacked the bottom one was ready to take out. I loosened the bottom clamps and removed that panel without disturbing any of the others. Then, I glued up another panel and put it into that one's place. Don't use excess glue or it will drip onto panels below. Or, place wax paper between layers.

*—Tested by Steve Feeney*

**Stackable panel clamps**

| | |
|---|---|
| Performance | ★★★★☆ |
| Price | $195, 6-clamp, 2' starter kit |

R&R Clamp
920-863-2987; rrclamp.com